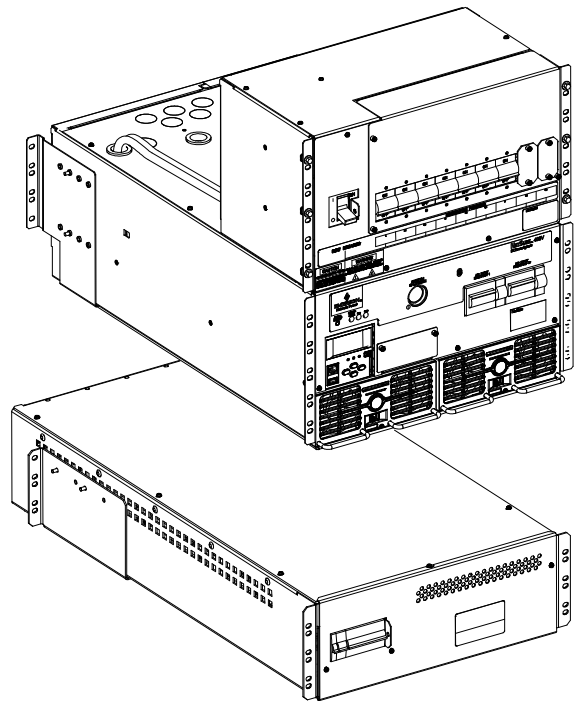


# NetSure™ 4015 30kW 400V DC Power System

## Installation Instructions

IM584000300 (Issue AB, April 3, 2013)

COMPONENT	SPEC. NO. 584000300	MODEL
INTEGRATED SYSTEM	LIST R1, R2	4015-X003
LOAD DISTRIBUTION SUB-RACK HRMG Configuration (w/ row breaker) NPG Configuration (w/ row breaker) HRMG Configuration (w/out row breaker) NPG Configuration (w/out row breaker)	LIST 21 LIST 22 LIST 23 LIST 24	--
POWER AND CONTROL SUB-RACK HRMG Configuration NPG Configuration	LIST 11 LIST 12	4015-X003
BATTERY TRAY HRMG Configuration NPG Configuration	LIST 91 LIST 92	--



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# IMPORTANT SAFETY INSTRUCTIONS

## GENERAL SAFETY



**DANGER! YOU MUST FOLLOW APPROVED SAFETY PROCEDURES.**

*Performing the following procedures may expose you to hazards. These procedures should be performed by qualified technicians familiar with the hazards associated with this type of equipment. These hazards may include shock, energy, and/or burns. To avoid these hazards:*

- a) The tasks should be performed in the order indicated.*
- b) Remove watches, rings, and other metal objects.*
- c) Prior to contacting any uninsulated surface or termination, use a voltmeter to verify that no voltage or the expected voltage is present.*
- d) Wear eye protection, and use recommended tools.*
- e) Use double insulated tools appropriately rated for the work to be performed.*
- f) Do not work on an energized system without full arc flash and PPE protection.*



**DANGER! All power and control wiring should be installed by a qualified electrician. All power and control wiring must comply with the National Electrical Code (NEC) and applicable local codes. For operation in countries where the NEC is not recognized, follow applicable codes.**



**CAUTION! Performing maintenance and/or troubleshooting procedures may interrupt power to the loads, if battery reserve is not sufficient or present.**

## VOLTAGES

### AC Input Voltages



**DANGER! This system operates from AC voltage capable of producing fatal electrical shock. AC input power must be completely disconnected from the branch circuits wiring used to provide power to the system before any AC electrical connections are made. Follow local lockout/tagout procedures to ensure upstream branch circuit breakers remain de-energized during installation. DO NOT apply AC power to the system until all electrical connections have been completed and checked.**

### DC Input/Output Voltages



**DANGER! This system produces DC power and may have a battery source connected to it. The DC voltage IS hazardously high and the rectifiers and/or battery can deliver large amounts of current. Exercise extreme caution not to inadvertently contact or have any tool inadvertently contact an output terminal or battery terminal or exposed wire connected to an output terminal or battery terminal. NEVER allow a metal object, such as a tool, to contact more than one termination at a time, or to simultaneously contact a termination and a grounded object. Even a momentary short circuit can cause explosion and injury. Remove watches, rings, and other metal objects before connecting battery leads.**

**Follow local lockout/tagout procedures to ensure DC branch circuit breakers remain de-energized during installation at loads, as required.**

**Extreme caution is required when performing maintenance. Be constantly aware that this system contains high DC as well as AC voltages.**

**The maximum output voltage is 400V DC and is potentially lethal.**

**Check for voltage with both AC and DC voltmeters prior to making contact.**

## BATTERY (IF EQUIPPED)



**DANGER!** When connected together, the battery terminal voltage is 400V DC and is potentially lethal. Battery strings should be isolated from the power system before servicing.



**WARNING!** Correct polarity must be observed when connecting battery leads.

**WARNING!** Special safety precautions are required for procedures involving handling, installing, and servicing batteries. Observe all battery safety precautions in this manual and in the battery instruction manual. These precautions should be followed implicitly at all times.

**WARNING!** A battery can present a risk of electrical shock and high short circuit current. Servicing of batteries should be performed or supervised only by properly trained and qualified personnel knowledgeable about batteries and the required precautions.

*The following precautions should be observed when working on batteries:*

- Remove watches, rings, and other metal objects.
- Eye protection should be worn to prevent injury from accidental electrical arcs.
- Use certified and well maintained insulated tools. Use double insulated tools appropriately rated for the work to be performed. Ensure that wrenches with more than one working end have only one end exposed.
- Do not lay tools or metal parts on top of batteries.
- Disconnect charging source prior to connecting or disconnecting battery terminals.
- Risk of explosion if battery is replaced with an incorrect type or if polarity is reversed. When replacing batteries, replace with the same manufacturer and type, or equivalent. See your local Emerson representative for a list of approved batteries.
- Dispose of used batteries according to the instructions provided with the batteries. Do not dispose of batteries in a fire. They may explode.
- ALWAYS FOLLOW THE BATTERY MANUFACTURER'S RECOMMENDATIONS AND SAFETY INSTRUCTIONS.

*In addition to the hazard of electric shock, gas produced by batteries can be explosive and sulfuric acid can cause severe burns. Do not open or mutilate batteries. Released electrolyte is harmful to the skin and eyes, and is toxic. If electrolyte comes into contact with skin, the affected area should be washed immediately with large amounts of water.*



***DANGER! THIS EQUIPMENT MAY BE USED IN CONJUNCTION WITH LEAD-ACID BATTERIES. WORKING NEAR LEAD-ACID BATTERIES IS DANGEROUS!***

- Batteries contain sulfuric acid.
- Batteries generate explosive gases during normal operation. Systems containing batteries should never be installed in an airtight room or space. Only install in a ventilated environment.
- Batteries are an energy source that can produce high amounts of electrical current.

***FOR THESE REASONS, IT IS OF CRITICAL IMPORTANCE THAT YOU READ THESE INSTRUCTIONS AND FOLLOW THEM EXACTLY.***

***WHEN WORKING WITH LEAD-ACID BATTERIES:***

- Wear complete protection for eyes, face, hands, and clothing. Examples are safety goggles or face shield, a rubber apron and gloves.
- If battery acid enters your eye, immediately flush your eye with running cold water for at least 15 minutes. Get medical attention immediately.
- If battery acid contacts skin or clothing, wash immediately with soap and water.

## PERSONAL PROTECTIVE EQUIPMENT (PPE)



***DANGER! ARC FLASH AND SHOCK HAZARD.***

***When working on this equipment appropriate PPE and tools required. An appropriate flash protection boundary analysis should be done determine the "hazard/risk" category, and to select proper PPE. Notice that PPE is applicable for both AC and DC voltages.***



***This product is intended only for installation in a Restricted Access Location.***

***Only authorized and properly trained personnel should be allowed to install, inspect, operate, or maintain the rack/equipment.***

***Do not work on LIVE parts. If required to work or operate live parts, obtain appropriate Energized Work Permits as required by the local authority, per NFPA 70E "Standard for Electrical Safety in the Workplace".***

## MAINTENANCE AND SERVICING PROCEDURES

### General



**WARNING!** All equipment maintenance and servicing procedures involve internal access and should be carried out only by trained personnel on a de-energized system. Extreme caution is required when performing maintenance and servicing procedures. Be constantly aware that this system contains high DC as well as AC voltages. Check for voltage with both AC and DC voltmeters prior to making contact.

Special safety precautions are required for procedures involving maintenance of this system and the batteries. Observe all safety precautions in this manual and in the battery instruction manual before as well as during performance of all maintenance procedures. Observe all battery safety precautions before working on or near the batteries. Service personnel and test equipment should be standing on rubber mats. Service personnel should wear insulating shoes for isolation from direct contact with the floor (earth ground).

This equipment contains several circuits that are energized with dangerous voltage. Only test equipment designed for troubleshooting should be used. This is particularly true for oscilloscopes. Always check with an AC and DC voltmeter to ensure safety before making contact or using tools. Even when the power is turned OFF, dangerously high electric charges may exist within the system.

Never work alone, even if all power is removed from the equipment. A second person should be standing by to assist and summon help in case an accident should occur.

### Dual Hazardous Input Power Sources



**WARNING!** The system may be powered from dual hazardous input power sources simultaneously: Commercial AC and Battery DC. Disconnect both sources of power before servicing.

## CIRCUIT CARD HANDLING



**WARNING!** Installation or removal of the circuit cards requires careful handling. Before handling any circuit card, read and follow the instructions contained on the Static Warning Page.



## STATIC WARNING



The printed circuit cards used in this equipment contain static sensitive components. The warnings listed below must be observed to prevent damage to these components. Disregarding any of these warnings may result in personal injury or damage to the equipment.

1. Strictly adhere to the procedures provided in this document.
2. Before touching any static sensitive component or printed circuit card containing such a component, discharge all static electricity from yourself by wearing a wrist strap grounded through a one megohm resistor. Some wrist straps, such as Emerson Network Power Part Number 631810600, have a built-in one megohm resistor; no external resistor is necessary. Read and follow wrist strap manufacturer's instructions outlining use of a specific wrist strap.
3. Do not touch the traces or components on a printed circuit card containing static sensitive components. Handle the printed circuit card only by the edges that do not have connector pads.
4. After removing a printed circuit card containing a static sensitive component, place the printed circuit card only on conductive or anti-static material such as conductive foam, conductive plastic, or aluminum foil. Do not use ordinary Styrofoam or ordinary plastic.
5. Store and ship static sensitive devices or printed circuit cards containing such components only in static shielding containers.
6. If necessary to repair a printed circuit card containing a static sensitive component, wear an appropriately grounded wrist strap, work on a conductive surface, use a grounded soldering iron, and use grounded test equipment.

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# CHAPTER 1. GENERAL INFORMATION AND INSTALLATION ACCEPTANCE CHECKLIST

## CUSTOMER DOCUMENTATION PACKAGE

This document (IM584000300) provides *Installation Instructions* for NetSure™ Power System Model **4015-X003**, Spec. No. **584000300**, and the individual components (Spec. Nos. listed on the front cover of this document) comprising the system.

The complete Customer Documentation Package consists of...

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### Bound System Installation Manual

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- |   |             |
|---|-------------|
| • Power System Installation Instructions: | IM584000300 |
|---|-------------|

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### Bound System Operation Manual

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- |  |               |
|--|---------------|
| • Power System Operation Instructions:     | UM584000300   |
| • Rectifier Instructions:                  | UM1R40015000e |
| • Power System “System Application Guide”: | SAG584000300  |

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### Bound ACU+ Controller Operation Manual

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- |   |              |
|---|--------------|
| • ACU+ Controller Operation Instructions: | UM1M820NNB-1 |
|---|--------------|

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### USB Drive with All Customer Documentation

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- |   |               |
|---|---------------|
| • Power System Installation Instructions:   | IM584000300   |
| • Power System Operation Instructions:  | UM584000300   |
| • Rectifier Instructions:   | UM1R40015000e |
| • Power System “System Application Guide”:  | SAG584000300  |
| • ACU+ Controller Operation Instructions:   | UM1M820NNB-1  |
| • Also provided on the USB drive is an ACU+ configuration drawing and the ACU+ configuration files loaded into the ACU+ as shipped. |               |

## SYSTEM PACKAGING

The following describes how the system components and hardware are packaged for shipment, and provides a means of identifying the components and hardware described in these instructions.

**Note:** *Not all parts may be included in every order.*

## Power and Control Sub-Rack (List 11, 12)

### General

Item	Part Number	Qty.
Power and Control Sub-Rack	553199 (List 11) 554097 (List 12)	1
Rear Mounting Brackets (Sub-Rack)	553313 and 554423	1, each
Screws to Mount Rear Mounting Brackets to Sub-Rack (10-32 x 1/2")	221671400	6
Cage Nuts (Sub-Rack Data Rack Mounting)	P88577	20
Sub-Rack Mounting Screws for Use with Cage Nuts (Sub-Rack Data Rack Mounting)	P94896	20
Snap Bushing, 1.093	244823100	5
Snap Bushing, 1.75	244823800	1
Hole Plug, 1.375	144152	1
KEPS Nuts (10-32) (AC Ground)	104564	4
KEPS Nuts (1/4-20) (DC Load and Battery)	116638	40
USB Flash Drive (Config File)	144345	1
Cabinet Grounding Jumper	554932	1
Flat Washer, 1/4" (Data Rack Ground Bar)	214110100	40
Lock Washer, 1/4" (Data Rack Ground Bar)	215111100	40
Screw, 1/4-20 x 3/4" (Data Rack Ground Bar)	227640400	40
Screw, 6-32 x 3/8" (Spares for Rear Cover)	233362700	4

### Rectifiers

Item	Part Number	Qty.
Rectifier	1R40015000e	1 or 2

### Temperature Probes (List 98, 99)

Item	Part Number	Qty.
Temperature Probe, 12 Feet (4m)	04118246 and 04118247	1, each
Temperature Probe, 33 Feet (10m)	04118246 and 04116740	1, each

## DC Load Distribution Sub-Rack (List 21, 22, 23, 24)

### General

Item	Part Number	Qty.
DC Load Distribution Sub-Rack	553221 (List 21) 553663 (List 22) 553349 (List 23) 554061 (List 24)	1
Cage Nuts (Sub-Rack Data Rack Mounting)	P88577	8
Sub-Rack Mounting Screws for Use with Cage Nuts (Sub-Rack Data Rack Mounting)	P94896	8
KEPS Nut, 1/4-20 (Ground)	116638	1
Cabinet Grounding Jumper	554931	1
Flat Washer, 1/4" (Data Rack Ground Bar)	214110100	3
Lock Washer, 1/4" (Data Rack Ground Bar)	215111100	3
Screw, 1/4-20 x 3/4" (Data Rack Ground Bar)	227640400	3
Edging	101331	1

## Battery Tray (List 91, 92)

### General

Item	Part Number	Qty.
Battery Tray	553266 (List 91) 554671 (List 92)	1
Six (6) Battery Sub-Trays with Batteries	553524	1
Rear Mounting Brackets (Tray)	553158 and 554041	1, each
Screws to Mount Rear Mounting Brackets to Tray (10-32 x 1/2")	221671400	6
Cage Nuts (Tray Data Rack Mounting)	P88577	16
Sub-Rack Mounting Screws for Use with Cage Nuts (Tray Data Rack Mounting)	P94896	16
Alarm/Control Harness, Multiple Shelves	553614	1
Tray Grounding Jumper	554933	1
Flat Washer, 1/4" (Data Rack Ground Bar)	214110100	4
Lock Washer, 1/4" (Data Rack Ground Bar)	215111100	4
Screw, 1/4-20 x 3/4" (Data Rack Ground Bar)	227640400	4

## RECOMMENDED TOOLS AND TEST EQUIPMENT

The following tools and test equipment are recommended to install the DC Power System.

Contact Emerson for a full turn key installation quote.

- Non-Contact Voltage Detector
- Digital Multimeter (DMM), capable of measuring system AC input and DC output voltages
- NO-OX-ID-A or Approved Equivalent
- Lineman's Scissors
- Lineman's Strippers
- Lineman's Cutters
- Electrician's Insulated Screwdrivers, Phillips, No. 1 and 2
- Electrician's Insulated Screwdrivers, Flat-Blade, Small and Large
- Adjustable Torque Wrench, 1/2" (13mm) Drive, 0 in-lb (0 Nm) to 100 in-lb (11 Nm)
- Ratchet, 1/2" (13mm) Drive
- Insulated Nut Driver Set
- Hexagonal Bit Set

## INSTALLATION ACCEPTANCE CHECKLIST

### General

The individual components of the DC Power System may be shipped as a complete solution factory installed and wired in an IT rack, or may be shipped separately to be installed in a customer provided IT rack.

Provided next is an Installation Acceptance Checklists for each option:

- Factory Integrated System (List R1, R2)
- Customer Integrated System (ship loose)

These Installation Acceptance Checklists help ensure proper installation and initial operation of the system. As the procedures presented in Chapters 2 through 5 of this document are completed, check the appropriate box on the appropriate Installation Acceptance Checklist. If the procedure is not required to be performed for your installation site, also check the box to indicate that the procedure was read. When installation is done, ensure that each block in the appropriate Installation Acceptance Checklist has been checked. Some of these procedures may have been factory performed for you.

**Note:** *The system is not powered up until the end of the Installation Acceptance Checklist.*

**Note:** *Some of these procedures may have been performed at the factory for you.*

### Checklist –Factory Integrated System (List R1, R2)

---

#### Chapter 2. Installing the System

---

- ☐ Equipment Inspection Completed
- ☐ IT Rack Secured to Floor

---

#### Chapter 3. Making Electrical Connections

---

- ☐ IT Rack Grounding Connection (Frame Ground) Made
- ☐ AC Input Power and AC Input Equipment Grounding Connections Made
- ☐ DC Load Distribution Connections to List 21-24 Distribution Sub-Rack(s) Made (if furnished)
- ☐ Battery Sub-Trays Installed in List 91-92 Battery Tray(s) (if furnished)
- ☐ External Battery Connections Made (if required)
- ☐ IB2 (ACU+ Controller Interface Board) Connections Made (if required)
- ☐ ACU+ Controller Ethernet Connection Made (if required)
- ☐ Power and Control Sub-Rack Bulk Output Connections Made (if required)

---

#### Chapter 4. Installing the Rectifiers

---

- ☐ Rectifiers Installed

---

#### Chapter 5. Initially Starting the System

---

- ☐ System Started, Configured, and Checked



---

## Checklist – Customer Integrated System (ship loose)

---

### Chapter 2. Installing the System

---

- ☐ Equipment Inspection Completed
  - ☐ IT Rack Secured to Floor
  - ☐ Power and Control Sub-Rack, Load Distribution Sub-Rack(s), and Battery Tray(s) Installed in IT Rack
- 

### Chapter 3. Making Electrical Connections

---

- ☐ Sub-Racks Cabinet Grounding Connection (Frame Ground) Made
  - ☐ IT Rack Grounding Connection (Frame Ground) Made
  - ☐ Return Bar Grounding Connection Made (NPG Configuration Only)
  - ☐ HRMG Grounding Connection Made (HRMG Configuration Only)
  - ☐ Sub-Rack Electrical Interconnections Made
  - ☐ AC Input Power and AC Input Equipment Grounding Connections Made
  - ☐ DC Load Distribution Connections to List 21-24 Distribution Sub-Rack(s) Made (if furnished)
  - ☐ Battery Sub-Trays Installed in List 91-92 Battery Tray(s) (if furnished)
  - ☐ External Battery Connections Made (if required)
  - ☐ IB2 (ACU+ Controller Interface Board) Connections Made (if required)
  - ☐ ACU+ Controller Ethernet Connection Made (if required)
  - ☐ Power and Control Sub-Rack Bulk Output Connections Made (if required)
- 

### Chapter 4. Installing the Rectifiers

---

- ☐ Rectifiers Installed
- 

### Chapter 5. Initially Starting the System

---

- ☐ System Started, Configured, and Checked

## CHAPTER 2. INSTALLING THE SYSTEM

The individual components of the DC Power System may be shipped as a complete solution factory installed and wired in an IT rack, or may be shipped separately to be installed in a customer provided IT rack.

### GENERAL REQUIREMENTS

- This product is intended only for installation in a restricted access location on or above a non-combustible surface.
- Front and rear access is required for installation.
- Required minimum spacing from the rear of the power and control sub-rack to a wall or other solid surface is thirty-six (36) inches for proper ventilation of system components. Required minimum spacing from the rear of the load distribution sub-rack to a wall or other solid surface is twelve (12) inches for proper ventilation of system components.
- See Figure 2-1 for an air flow diagram.

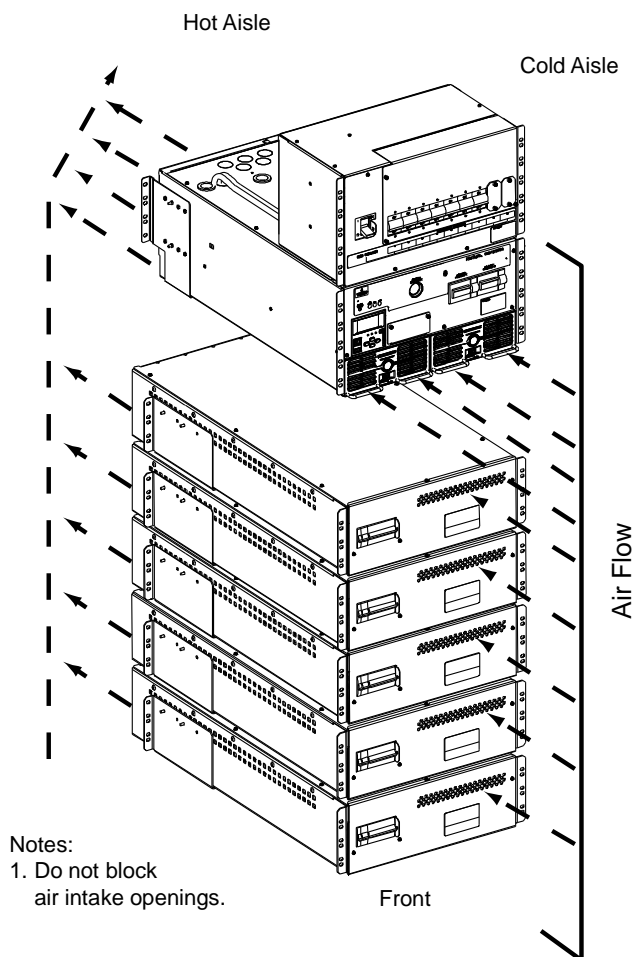


Figure 2-1  
Air Flow Diagram

## INSPECTING THE EQUIPMENT AND STORING FOR DELAYED INSTALLATIONS

### Inspecting the Equipment

Compare the contents of the shipment with the bill of lading. Report any missing items to the carrier and your local Emerson representative immediately.

While the DC Power System is still on the truck, inspect the equipment and shipping container(s) for any signs of damage or mishandling.

As the equipment is moved off the truck and unpacked, visually examine the DC Power System for transit damage.

Do not attempt to install the system if damage is apparent.

If any damage is noted, file a damage claim with the shipping agency within 24 hours and contact Emerson Network Power (number located on last pages of this document) to inform them of the damage claim and the condition of the equipment.

### Storing for Delayed Installation

If the equipment will not be installed immediately, it must be stored indoors where the humidity is no higher than 95%. The storage area must protect the DC Power System from excessive moisture.

## SECURING THE IT RACK TO THE FLOOR

Secure the IT rack to the floor per site requirements. Refer also to the *General Requirements* section at the beginning of this chapter.

### Factory Integrated Systems (List R1, R2)

For systems factory furnished in an IT rack (List R1, R2), position and secure the Emerson Network Power DCM IT Rack to the floor as follows.

---

#### Procedure

---

- 1) Use at least two people when moving the IT rack.
- 2) Using a pallet jack or forklift, move the IT rack on its pallet to the installation location.
- 3) Cut the shrink wrap and remove all packaging.
- 4) Remove the lag bolts securing each shipping bracket to the shipping pallet. There is one bracket at each corner of the IT rack (each bracket has two lag bolts).
- 5) Use a pallet jack or forklift to raise the IT rack off the shipping pallet.
- 6) Slide the shipping pallet out from under the IT rack.
- 7) The IT rack may be positioned for installation either with the forklift or by rolling the cabinet on its casters. If the casters are to be used to move the cabinet, prepare the IT rack for rolling as follows.
  - a) Set the IT rack on the floor.
  - b) Using a hex wrench, lower each leveling feet until the IT rack is not resting on the shipping brackets.
  - c) Remove the hex bolts securing each shipping bracket to the IT rack.

- d) Using a hex wrench, raise each leveling feet until the IT rack is resting on the casters.
- 8) Position the IT rack.
- 9) Lower the leveling feet or bolt the IT rack to the floor by using the shipping brackets (the shipping brackets will have to be re-attached to the IT rack if removed for rolling the IT rack into position).

## INSTALLING INDIVIDUAL SUB-RACKS INTO CUTOMER PROVIDED IT RACK (not applicable with List R1, R2)

For customer provided IT rack installation only.

**Danger:** *The IT rack must be securely anchored to the floor before the power and control sub-rack, load distribution sub-rack(s), and battery tray(s) are installed.*

### Customer Supplied IT Rack Guidelines

If you plan to assemble / configure your own system, note that the NetSure 4000 Series components (power and control sub-rack / load distribution sub-rack / battery tray) were evaluated as a UL Listed system in an Emerson Network Power DCM IT Rack in an ambient of +35°C (95°F), with a front and rear door free area ratio of 83%.

### Installing the Sub-Racks

If the system was ordered to be installed in a customer provided IT rack, install the individual components of the DC Power System into a 19" mounting frame of the IT rack.

---

#### Procedure

---

**Note:** *Refer to Figure 2-2 as this procedure is performed.*

- 1) If furnished, the DC load distribution sub-rack(s) is typically installed at the top of the IT rack.

**Note:** *The system can consist of 0-2 DC load distribution sub-rack(s).*

- a) Slide the DC load distribution sub-rack into position and secure the front mounting flanges to the IT rack with the furnished cage nuts and screws.
- b) Repeat this procedure if a second DC load distribution sub-rack is furnished.

- 2) The power and control sub-rack is typically installed below the DC load distribution sub-rack(s).

**Note:** *The system consists of one (1) power and control sub-rack.*

- a) Secure the rear mounting brackets to the IT rack with the furnished cage nuts and screws.
- b) Remove the rear cover from the power and control sub-rack.
- c) Slide the power and control sub-rack into the front of the IT rack until it is in position (with the bottom of the sub-rack resting on the angles of the rear mounting brackets).
- d) Secure the front mounting flanges to the IT rack with the furnished cage nuts and screws.

- e) Secure the rear mounting brackets to the power and control sub-rack with the furnished hardware (hardware is installed from inside the sub-rack, the rear mounting brackets have captive fasteners).
- 3) If furnished, the battery tray(s) is typically installed at the bottom of the IT rack due to the weight of the batteries.

**Note:** *Only install the battery tray(s) at this time. Battery sub-trays (with batteries) will be installed in the "Making Electrical Connections" section.*

**Note:** *The system can consist of 0-5 battery tray(s).*

**Note:** *Battery cables from the battery tray(s) can enter the power and control sub-rack from either the top or bottom of the power and control sub-rack. Note that a space is required between the power and control sub-rack and battery tray to allow the cables to enter from the bottom.*

- a) Secure the rear mounting brackets to the IT rack with the furnished cage nuts and screws.
- b) Slide the battery tray into the front of the IT rack until it is in position (with the bottom of the sub-rack resting on the angles of the rear mounting brackets).
- c) Secure the front mounting flanges to the IT rack with the furnished cage nuts and screws.
- d) Secure the rear mounting brackets to the battery tray with the furnished hardware (hardware is installed from inside the battery tray, the rear mounting brackets have captive fasteners).
- e) Repeat this procedure if other battery tray(s) are furnished.

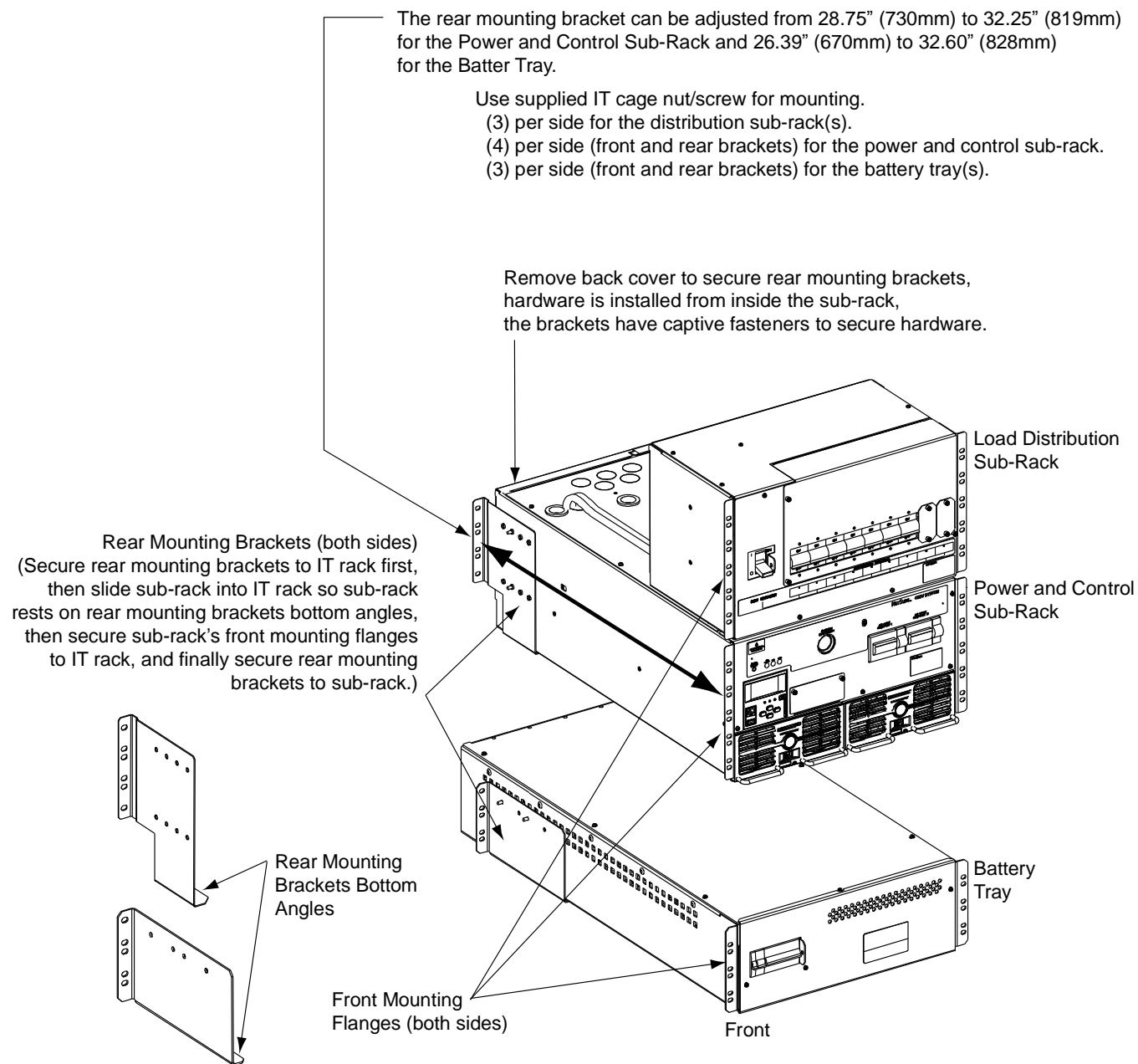


Figure 2-2  
Mounting Details

## Electrically Interconnecting the Sub-Rack(s)

The sub-racks are electrically interconnected later in the "Sub-Racks Electrical Interconnections" procedure on page 21.

## CHAPTER 3. MAKING ELECTRICAL CONNECTIONS

### IMPORTANT SAFETY INSTRUCTIONS

***Danger: Adhere to the "Important Safety Instructions" presented at the front of this document.***

### WIRING CONSIDERATIONS

All AC input and 400V DC output wiring, branch circuit protection, and grounding should follow the current edition of the American National Standards Institute (ANSI) approved National Fire Protection Association's (NFPA) National Electrical Code (NEC), and applicable local codes. For operation in countries where the NEC is not recognized, follow applicable codes.

**For wire size, branch circuit protection, crimp lug, and general wiring recommendations; refer to System Application Guide SAG584000300.**

### TORQUE

Torque all connections as specified in the illustrations presented in this chapter.

### OUTPUT GROUND CONFIGURATIONS

These instructions apply both to the High Resistance Midpoint Grounded (HRMG) and Negative Pole Grounded (NPG) configurations. Ensure you follow the proper procedures for the configuration you have. Refer to the part number on your equipment. The table on the front cover of this document lists the various equipment part numbers and the configuration they apply to.

### CABLE ROUTING

#### When System is Furnished in a Factory Provided IT Rack (List R1, R2)

If the system is furnished in a factory provided IT rack, connections between the system's sub-racks and also to the IT rack ground bar are factory made. The electrical connections the customer is required to make are the following. Refer to Figure 3-1 on the next page for a cable routing diagram.

- Site Ground to IT Rack Ground Bar (page 25)
- AC Input Connections (page 28)
- DC Load Distribution Connections to List 21-24 Distribution Sub-Rack(s) (page 29)
- Battery Sub-Trays Installed in List 91-92 Battery Tray(s) (page 31)
- External Batteries (if required) (page 33)
- IB2 (ACU+ Controller Interface Board) Connections (if required) (page 35)
- ACU+ Controller Ethernet Connection (if required) (page 36)
- Power and Control Sub-Rack Bulk Output Connections (if required) (page 40)

GO TO PAGE 25 FOR THE ELECTRICAL CONNECTIONS PROCEDURES.

Top Plate

Two options available:

1) P/N 554472.

Holes sized for imperial conduit fittings  
(25mm [1"] conduit fittings except AC Input and External  
Battery which are 32mm [1.25"] conduit fittings).

2) P/N 554473.

Holes sized for corded connections  
using metric cord grips (38mm [1.5"] holes).

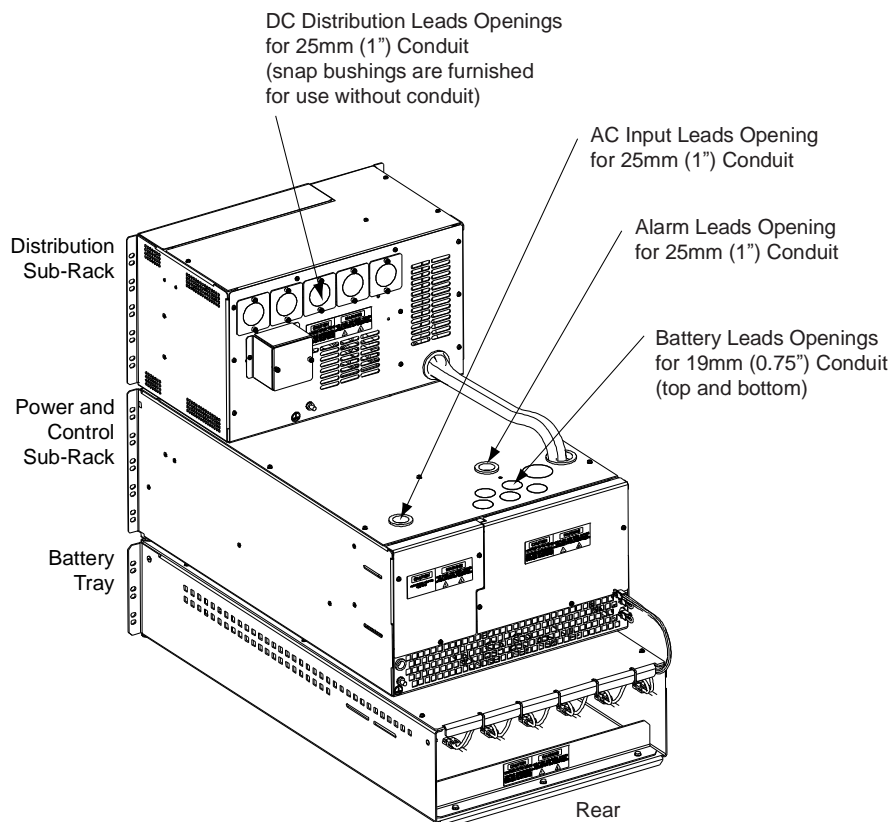
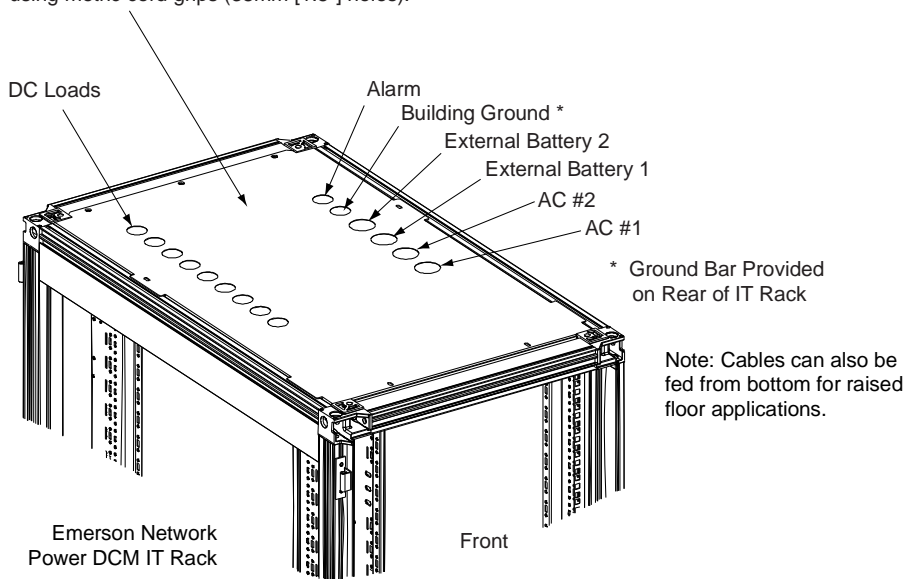


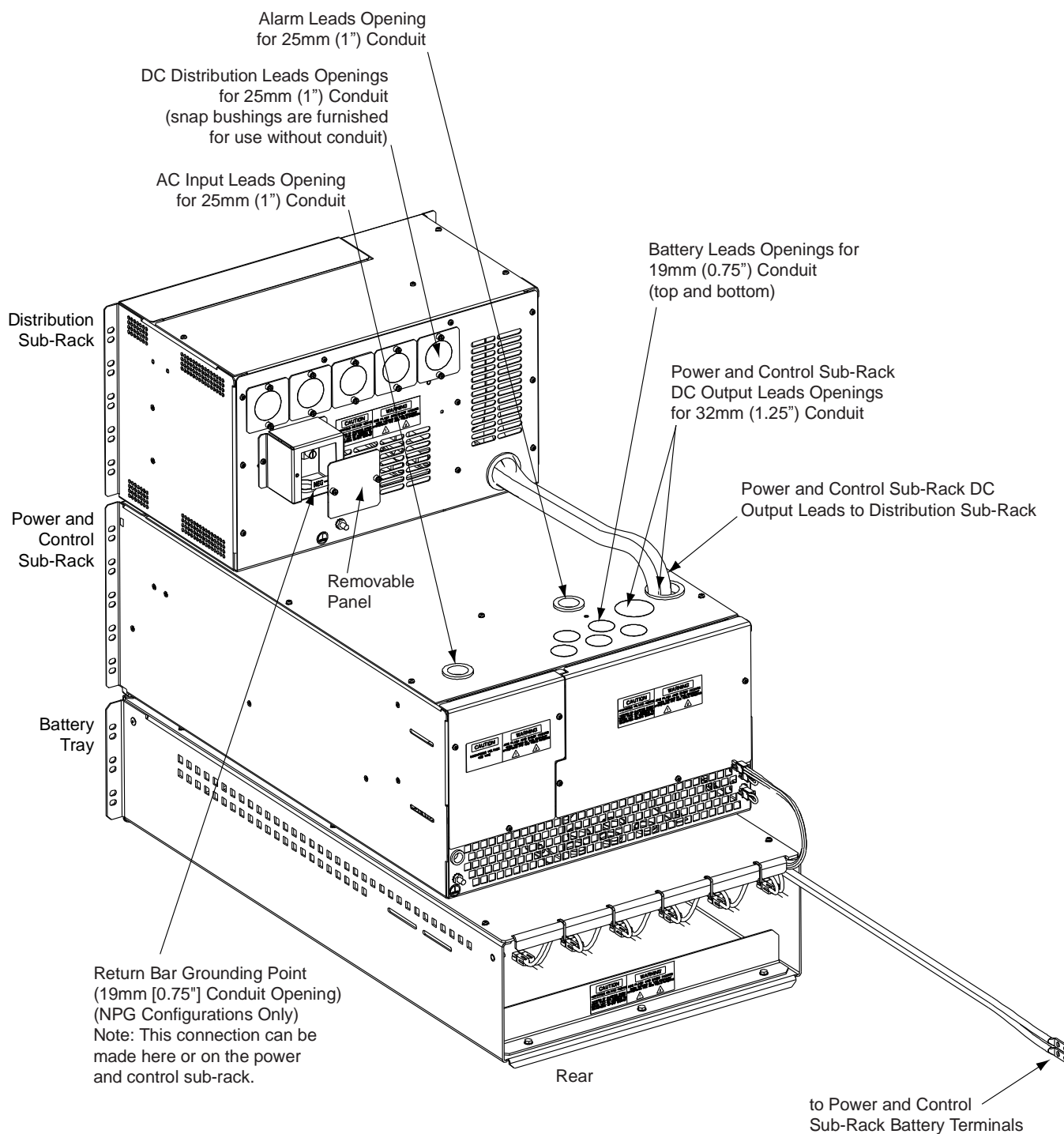
Figure 3-1  
Top Feed Cable Landing Diagram – Factory Provided IT Rack



## **When System Components are Furnished Loose to be Installed in a Customer Furnished IT Rack**

If the system components are furnished loose to be installed in a customer furnished IT rack, the following connections are required. Refer to Figure 3-2 for a cable routing diagram.

- Grounding Connections between the Sub-Racks and the IT Rack Ground Bar (page 17)
- Return Bar Grounding Connection (NPG Configurations Only) (page 17)
- HRMG Grounding Connection (HRMG Configurations Only) (page 17)
- Sub-Racks Electrical Interconnections (page 21)
- Site Ground to IT Rack Ground Bar (page 25)
- AC Input Connections (page 28)
- DC Load Distribution Connections to List 21-24 Distribution Sub-Rack(s) (page 29)
- Battery Sub-Trays Installed in List 91-92 Battery Tray(s) (page 31)
- External Batteries (if required) (page 33)
- IB2 (ACU+ Controller Interface Board) Connections (if required) (page 35)
- ACU+ Controller Ethernet Connection (if required) (page 36)
- Power and Control Sub-Rack Bulk Output Connections (if required) (page 40)



**Figure 3-2**  
**Individual Cable Landing Points – Sub-Racks**

## TASKS TO BE PERFORMED FOR CUSTOMER INTEGRATED SYSTEMS

ALSO MAKE THE CONNECTIONS DESCRIBED UNDER “Tasks to Be Perform for All Installations” STARTING ON PAGE 25.

### Grounding

***Danger: Failure to follow proper grounding procedures can result in electric shock hazard to personnel or the risk of fire, should a ground fault occur.***

For grounding requirements, refer to the current edition of the American National Standards Institute (ANSI) approved National Fire Protection Association's (NFPA) National Electrical Code (NEC), applicable local codes, and your specific site requirements. For operation in countries where the NEC is not recognized, follow applicable codes.

Refer to Figure 3-8 for a complete system grounding scheme diagram.

---

#### Sub-Rack Grounding (Frame Ground)

---

When individual system components are furnished, the individual components must be grounded on site by the customer after installation into an IT rack. A cabinet grounding stud is located on the rear of the power and control sub-rack and distribution sub-rack. A tray grounding stud is located on the rear side panel of the battery tray. Refer to Figure 3-3 for connection points.

---

#### NPG Configurations Only: Return Busbar (-Bus) Grounding Connection

---

The return busbar (-Bus) in a negative pole ground (NPG) configuration is to be connected to ground. A grounding connection point for the return busbar (-Bus) is provided on the negative bus in the power and control sub-rack. This connection can also be made on the rear of the load distribution sub-rack, if furnished. Only connect in one place. Refer to Figure 3-4 for connection points.

---

#### HRMG Configurations Only: Bus Grounding Connection

---

A lead exits the rear of the power and control sub-rack in a High Resistance Midpoint Ground (HRMG) configuration. This lead MUST be connected directly to ground for proper operation of the mid-point grounding circuit and the ground fault detection circuit. Refer to Figure 3-5 for connection point.

***Caution: Failure to terminate this conductor to ground will render the system ground fault detection circuit and the  $\pm 200V$  DC voltage reference inoperable. It is essential to properly bond this lead to ground.***

***Note: This lead is 16 AWG, approximately 100" long, and terminated in a ring lug with a 1/4" clearance hole.***

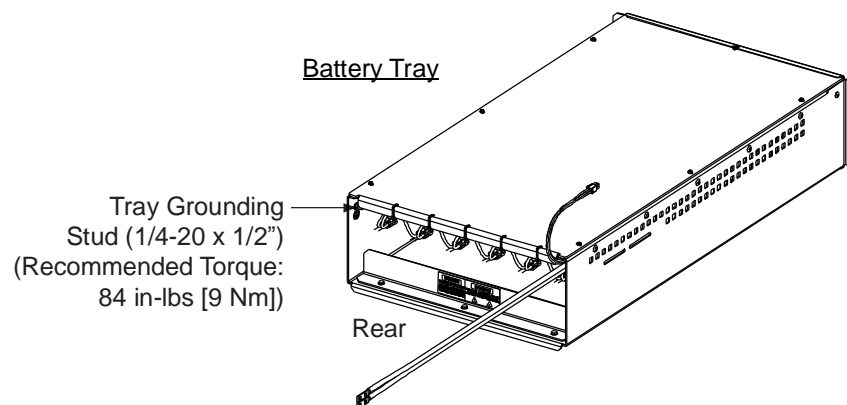
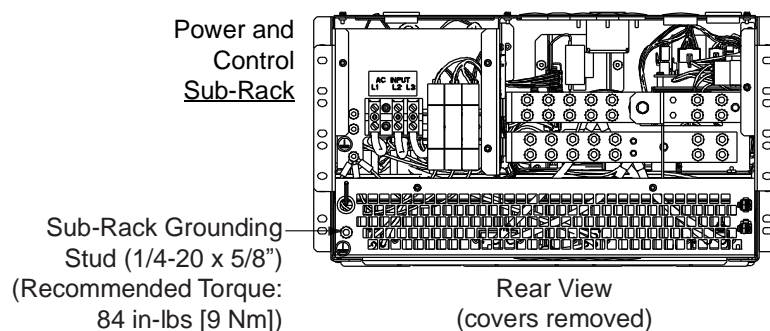
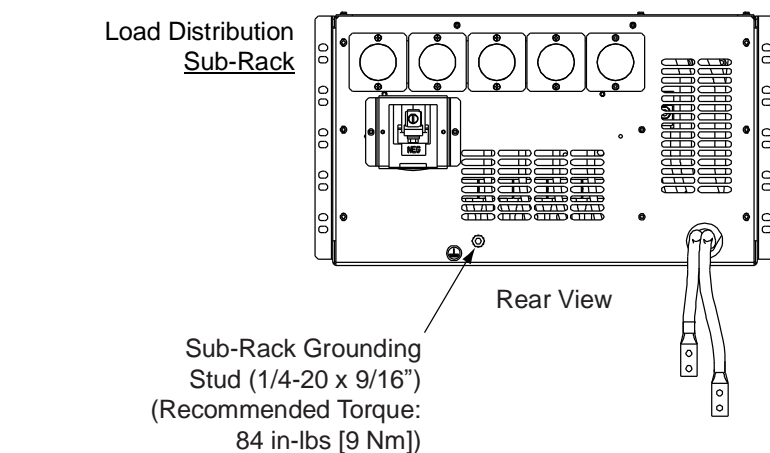
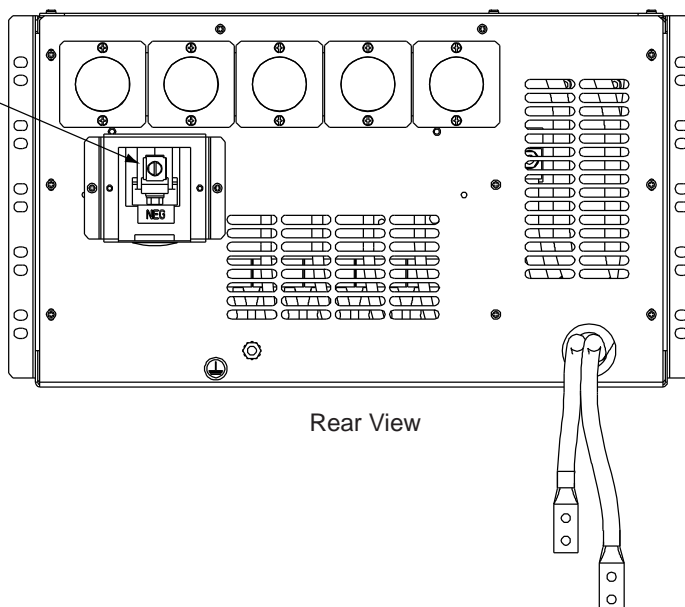


Figure 3-3  
Sub-Racks Frame Grounding Connections

### Load Distribution Sub-Rack

Return Busbar (-Bus)  
Grounding Point  
(cover removed)  
(NPG Configurations Only)  
Note: This connection can be made here or on the power and control sub-rack as shown below.

(Wire Size Capacity:  
10 AWG to 4 AWG)  
(Recommended Torque:  
80 in-lbs [9 Nm])



Rear View

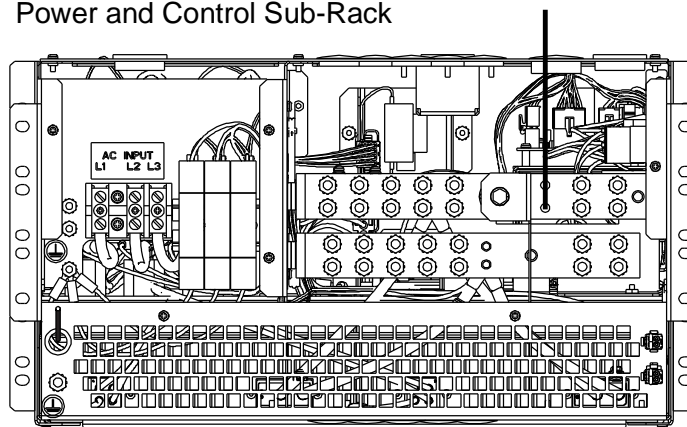
Caution: In the NPG Configuration, this equipment will have (after installation) a connection between the earthed conductor of the DC power supply circuit and the earthing conductor.

Return Busbar (-Bus)  
Grounding Point  
(NPG Configurations Only)  
Note: This connection can be made here or on the distribution sub-rack (if furnished) as shown above.

(Recommended Torque:  
84 in-lbs [9 Nm])

(one set of 1/4-20 x 1/2"  
studs on 5/8" centers  
for double hole lugs)

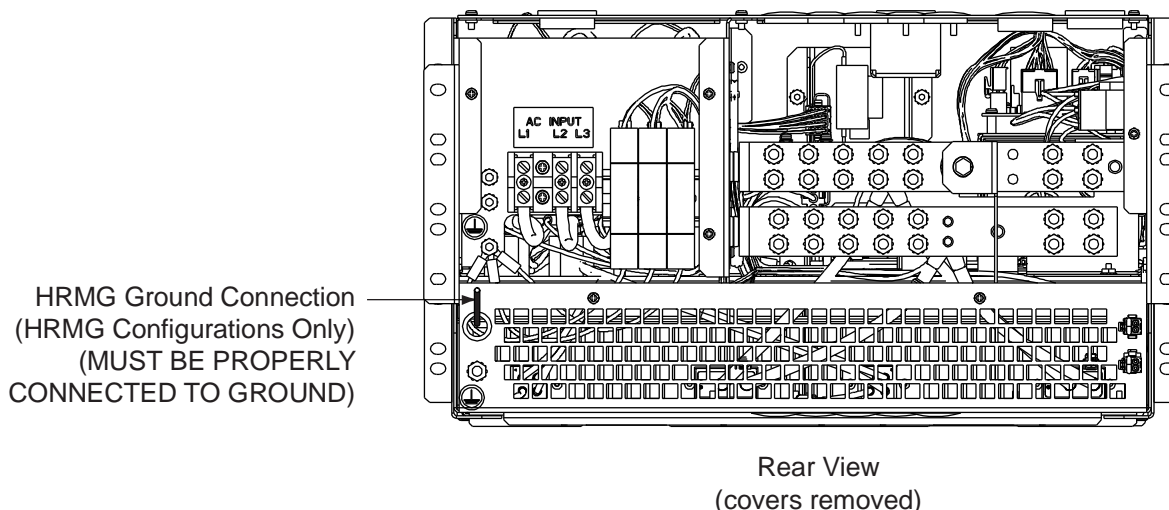
### Power and Control Sub-Rack



Rear View  
(covers removed)

Figure 3-4  
Return Busbar (-Bus) Grounding Connection (NPG Configurations Only)

### Power and Control Sub-Rack



A lead exits the rear of the power and control sub-rack in a High Resistance Midpoint Ground (HRMG) configuration. This lead **MUST** be connected directly to ground for proper operation of the mid-point grounding circuit and the ground fault detection circuit. This lead is 16 AWG, approximately 100" long, and terminated in a ring lug with a 1/4" clearance hole.

Figure 3-5  
HRMG Ground Connection (HRMG Configuration Only)

## Sub-Racks Electrical Interconnections

If the system components are furnished loose to be installed in a customer furnished IT rack, the following electrical interconnections are required.

---

### Connecting the Load Distribution Sub-Rack(s) to the Power and Control Sub-Rack

---

**Note:** *If you are connecting “bulk” loads, refer to “Power and Control Sub-Rack Bulk Output Connections (if required)” on page 40.*

#### Procedure

- 1) Locate the load distribution sub-rack input cables which are factory connected to the load distribution sub-rack. Route these cables into the power and control sub-rack. Connect these cables to the DC output terminals located inside the power and control sub-rack as follows. Repeat this procedure if a second load distribution sub-rack is furnished. Refer to Figure 3-6.
  - Connect the cable labeled  $+/-$  to the positive DC output terminals.
  - Connect the cable labeled  $-/-$  to the negative DC output terminals.

---

### Connecting the Battery Tray(s) to the Power and Control Sub-Rack

---

#### Procedure

- 1) Locate the battery tray output cables which are factory connected to the battery tray. Route these cables into the power and control sub-rack. Cables can be routed from the top or bottom into the power and control sub-rack. Connect these leads to the battery terminals located inside the power and control sub-rack as follows. Repeat this procedure if additional battery trays are furnished. Refer to Figure 3-6.
  - Connect the cable labeled  $+/-$  to the positive battery terminals.
  - Connect the cable labeled  $-/-$  to the negative battery terminals.

---

### Connecting the Battery Tray Control and Alarm Harness to Other Battery Trays and/or to the Power and Control Sub-Rack

---

#### Procedure

- 1) If only one battery tray is furnished, locate the control/alarm wire harness exiting the battery tray. Locate the two (2) battery control/alarm connectors located on the rear of the power and control sub-rack. Remove a termination plug from one of these connectors. Connect the extension control/alarm cable between the battery tray control/alarm wire harness and the power and control sub-rack connector which the termination plug was removed from. Refer to Figure 3-7.
- 2) If more than one battery tray is furnished, use the supplied battery tray control/alarm daisy chain cable as shown in Figure 3-7.

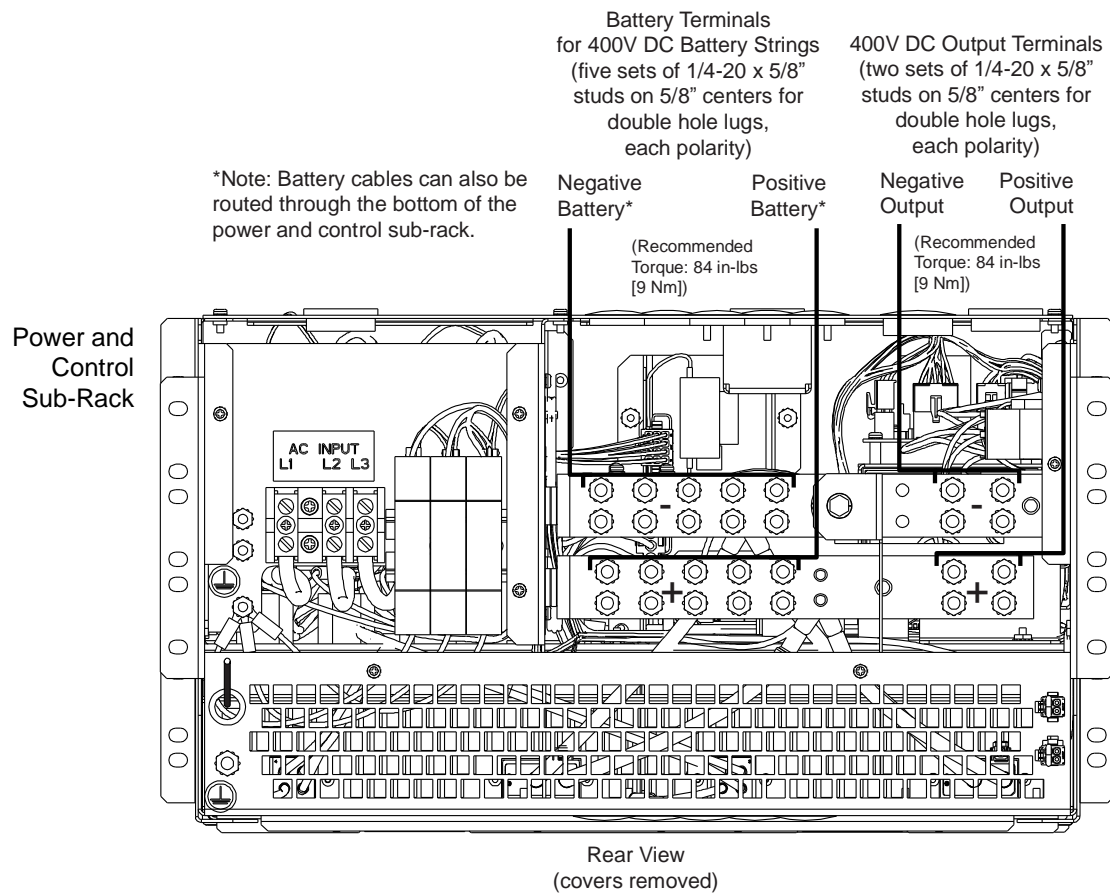
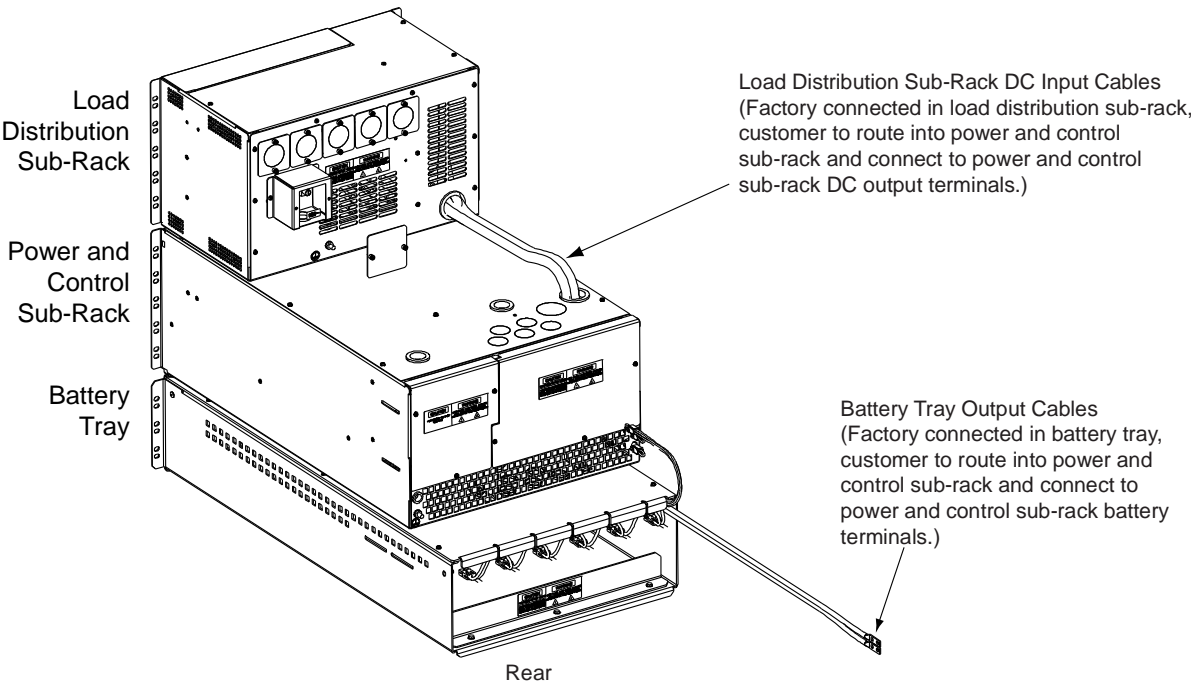


Figure 3-6  
Sub-Rack Interconnections



Battery Tray Alarm / Control Connections - 1 Tray Only

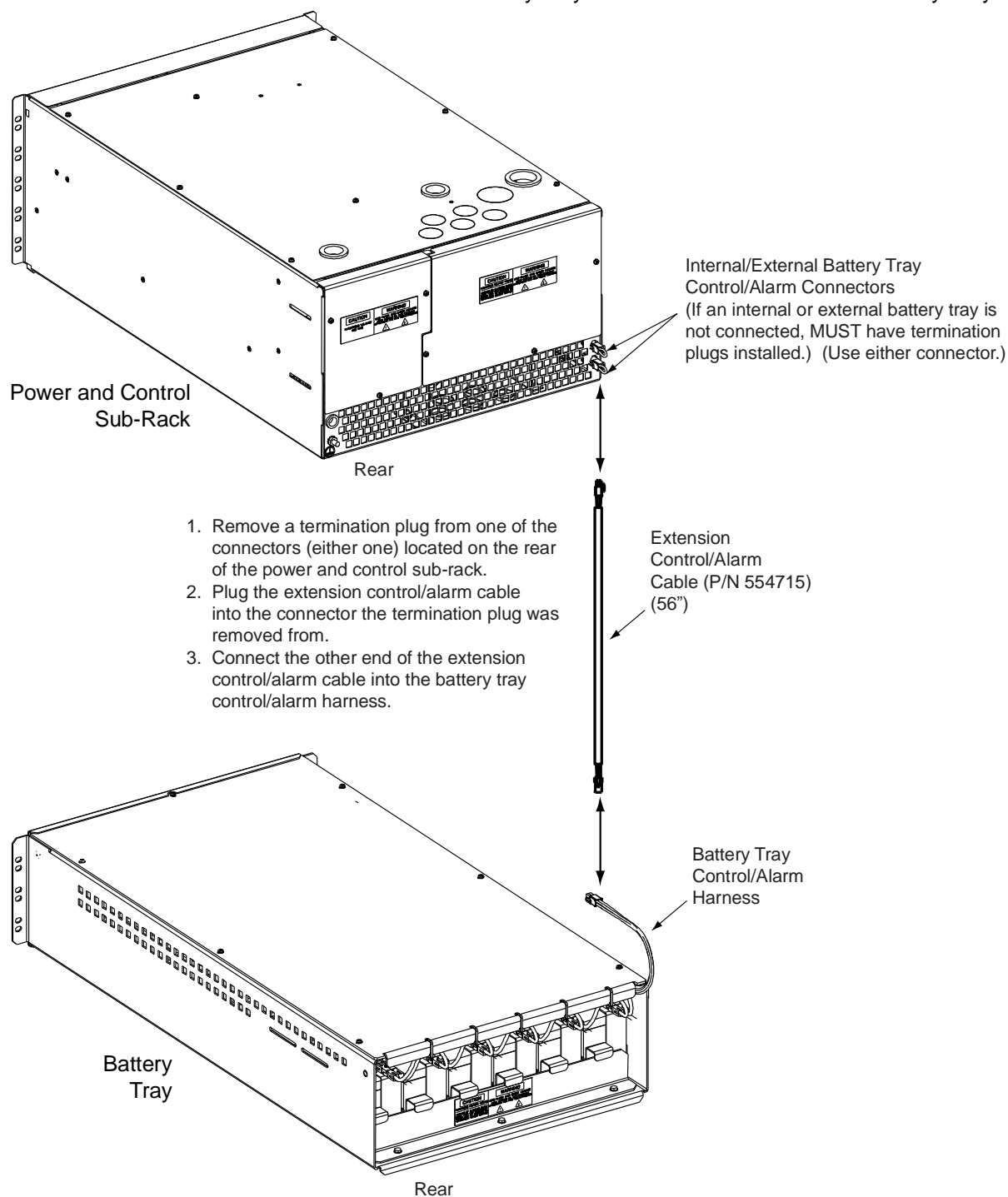
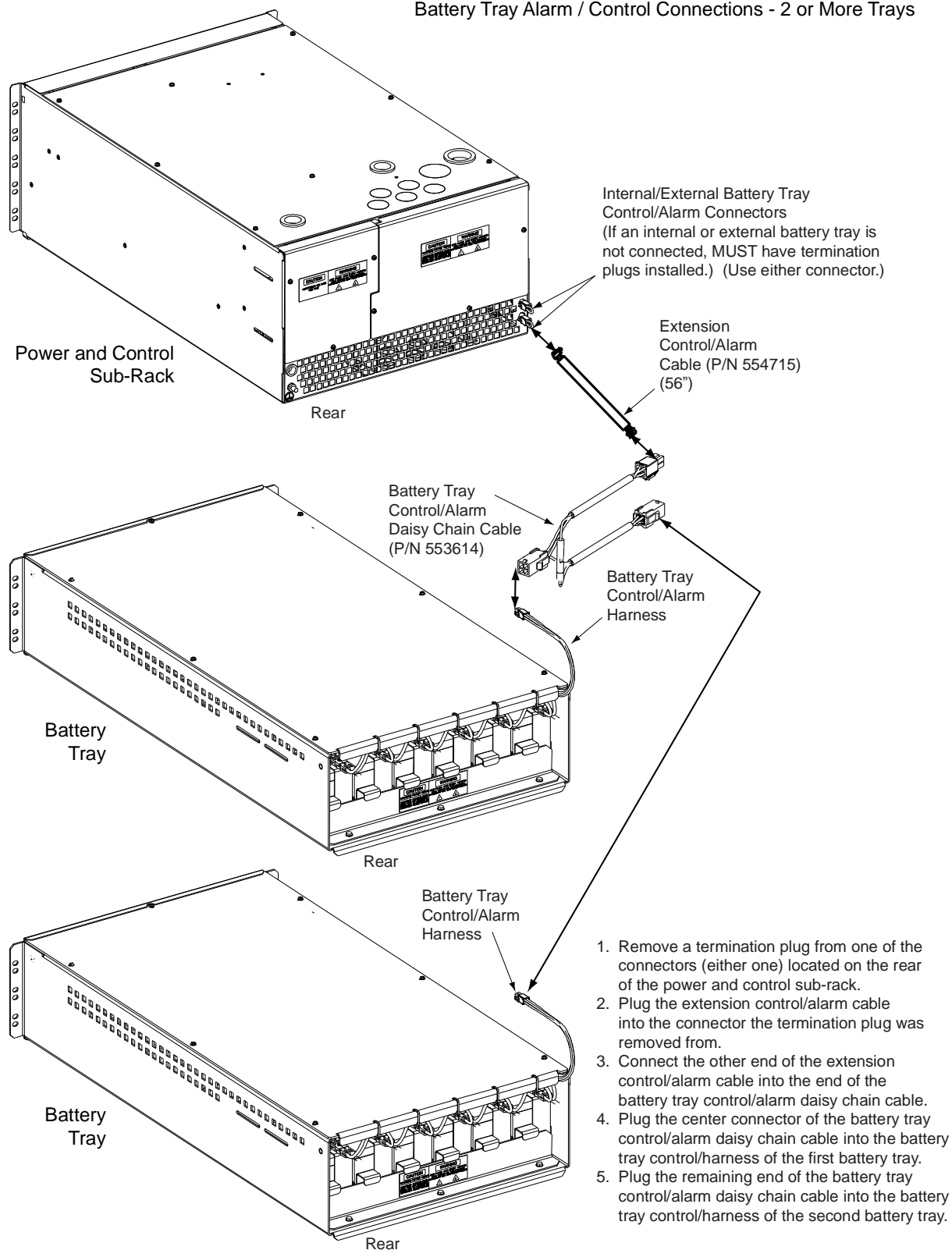


Figure 3-7 (cont'd on next page)  
Internal Battery Tray Interconnections

Battery Tray Alarm / Control Connections - 2 or More Trays



1. Remove a termination plug from one of the connectors (either one) located on the rear of the power and control sub-rack.
2. Plug the extension control/alarm cable into the connector the termination plug was removed from.
3. Connect the other end of the extension control/alarm cable into the end of the battery tray control/alarm daisy chain cable.
4. Plug the center connector of the battery tray control/alarm daisy chain cable into the battery tray control/harness of the first battery tray.
5. Plug the remaining end of the battery tray control/alarm daisy chain cable into the battery tray control/harness of the second battery tray.

Figure 3-7 (cont'd from previous page)  
Internal Battery Tray Interconnections

## TASKS TO BE PERFORM FOR ALL INSTALLATIONS

### Grounding

***Danger:*** *Failure to follow proper grounding procedures can result in electric shock hazard to personnel or the risk of fire, should a ground fault occur.*

For grounding requirements, refer to the current edition of the American National Standards Institute (ANSI) approved National Fire Protection Association's (NFPA) National Electrical Code (NEC), applicable local codes, and your specific site requirements. For operation in countries where the NEC is not recognized, follow applicable codes.

Refer to Figure 3-8 for a complete system grounding scheme diagram.

---

#### IT Rack Grounding (Frame Ground)

---

Supply a grounding lead from site ground to the IT rack ground bar. For factory integrated systems (List R1, R2), refer to Figure 3-9 for connection point.

***Note:*** *When the system is furnished in an IT rack, grounding leads are factory wired from the individual system components to a ground bar located on the rear left side of the furnished IT rack.*

---

#### Conduit Grounding (Frame Ground)

---

Conduit grounding points are provided on terminal strips located on the left and right inside side walls of the distribution sub-rack. Refer to Figure 3-9 for connection points.

## System Grounding Connections Overview

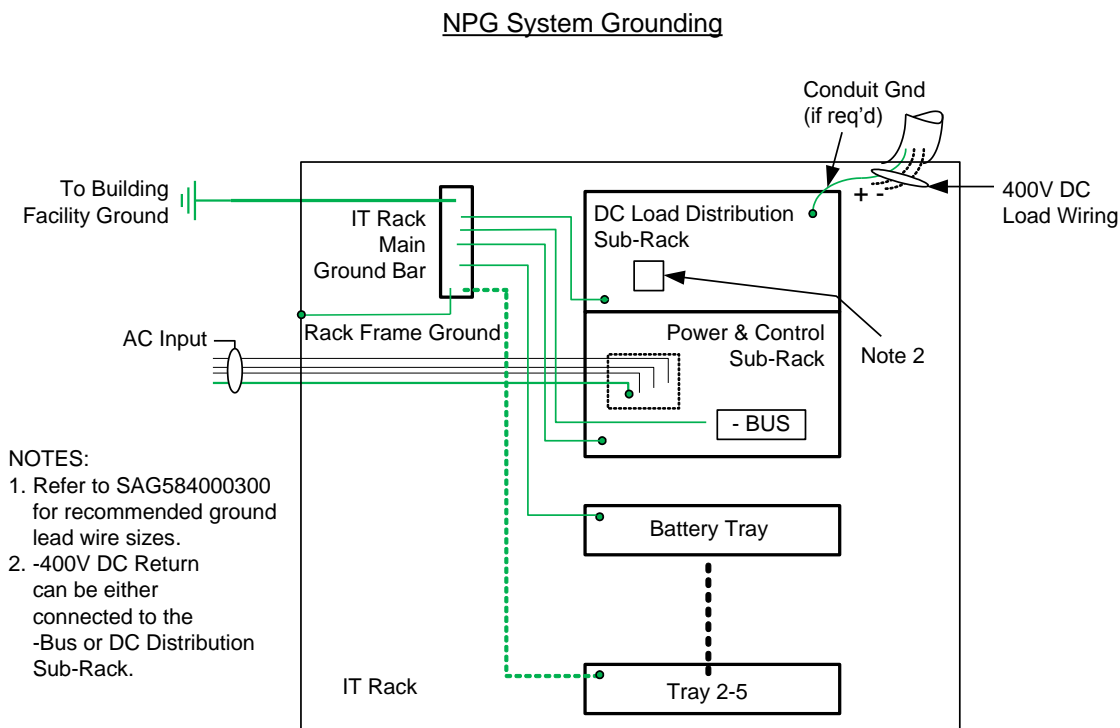
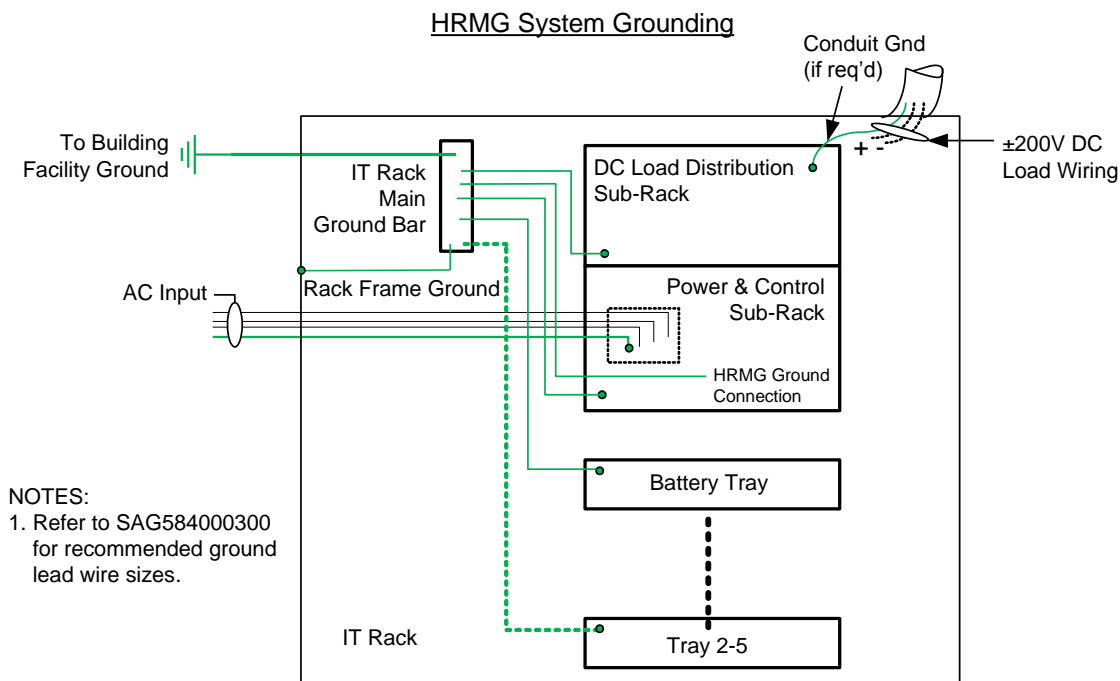
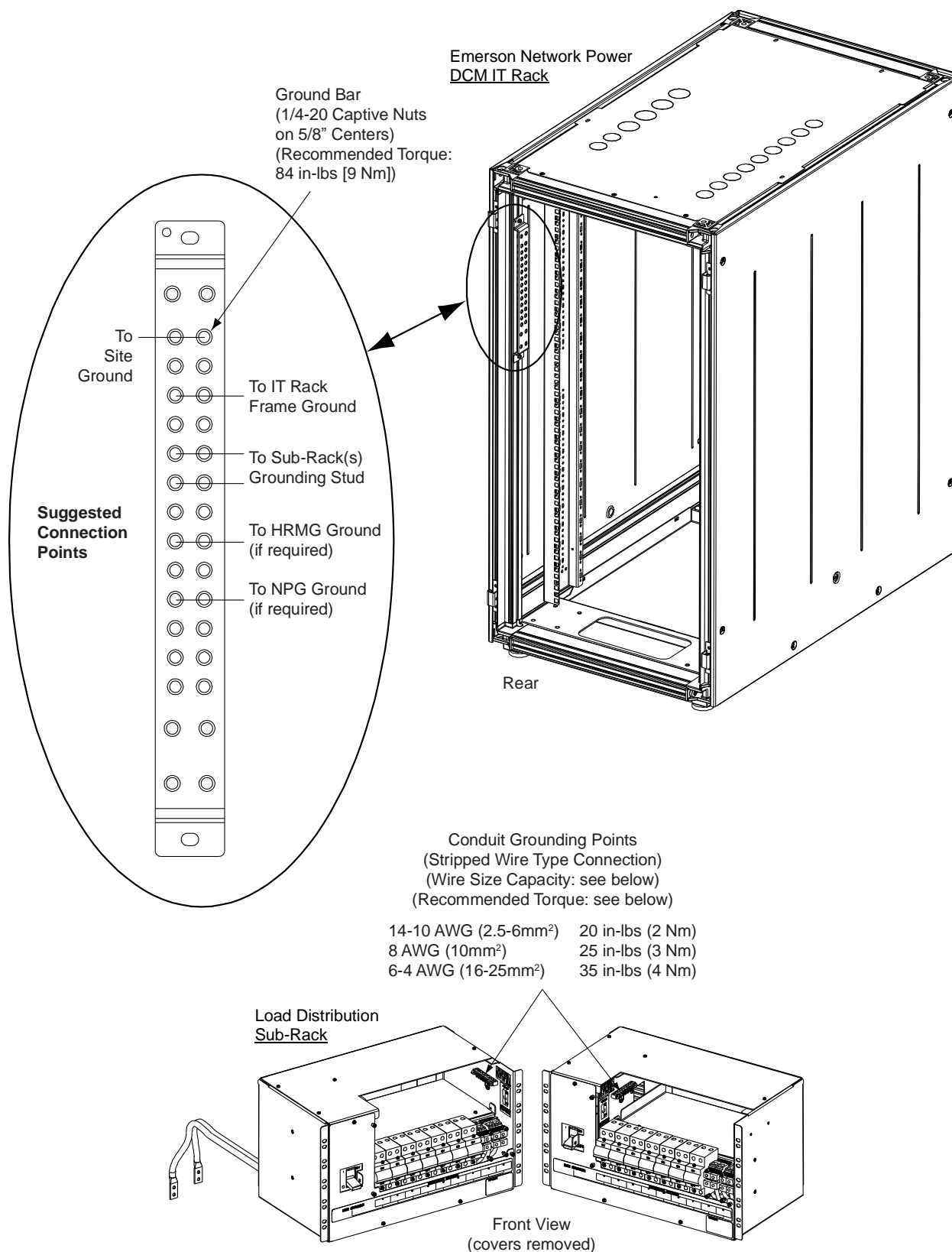


Figure 3-8  
Grounding Scheme Diagram



**Figure 3-9**  
IT Rack and Conduit Grounding Connections

## AC Input Power Connections

**Danger: Adhere to the “Important Safety Instructions” presented at the front of this document. DO NOT attempt to work on an energized system.**

AC input connections are made to an AC input terminal block located behind an access panel located on the rear of the power and control sub-rack. Studs are also provided for the AC Input ground leads. Refer to Figure 3-10 for location and connection details.

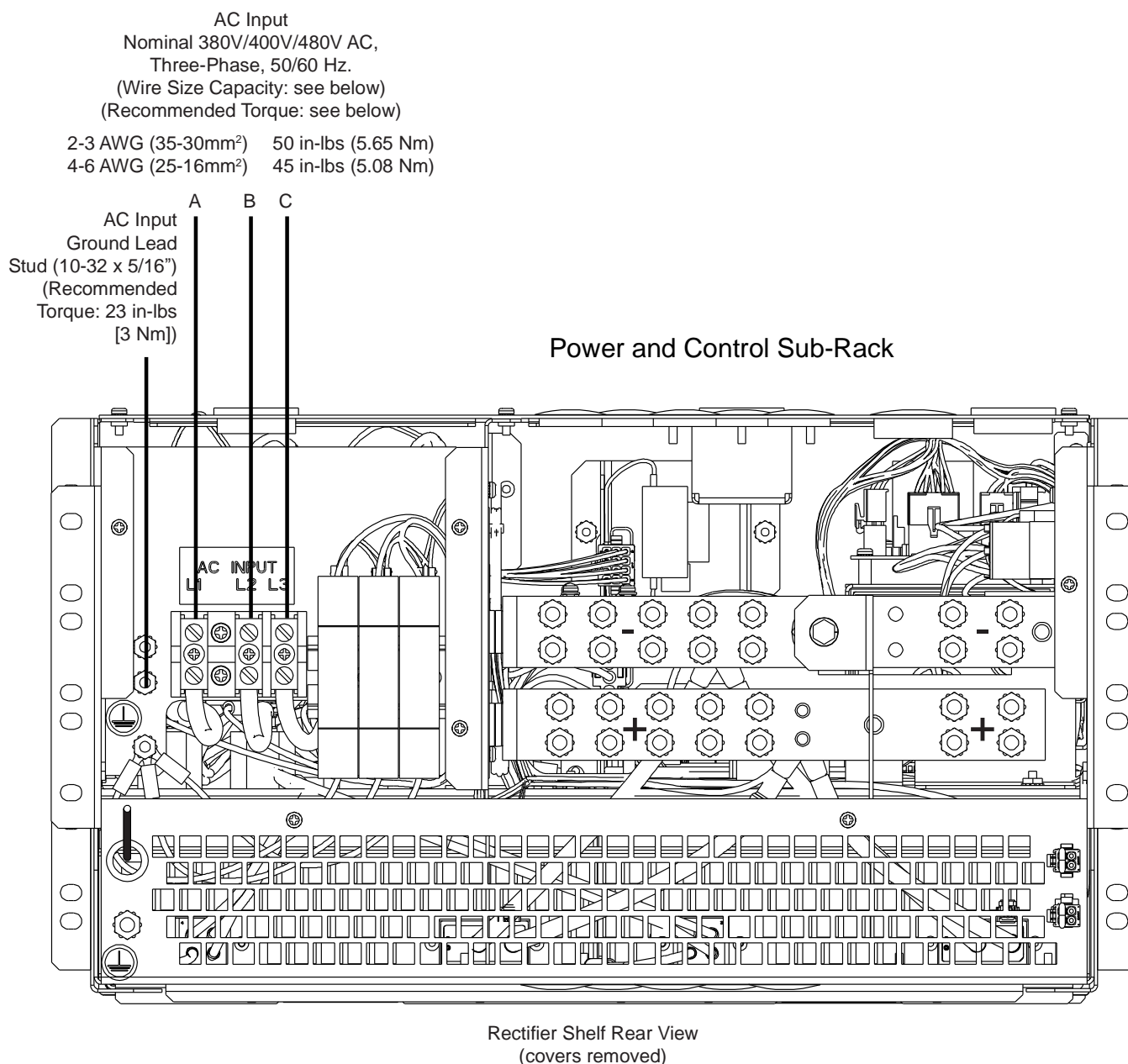


Figure 3-10  
AC Input Power Connections

---

## **DC Load Distribution Electrical Connections to List 21-24 DC Load Distribution Sub-Rack(s) (if furnished)**

***Danger:*** Adhere to the “Important Safety Instructions” presented at the front of this document. ***DO NOT*** attempt to work on an energized system.

***Warning:*** Check for correct polarity before making connections.

---

### **HRMG (High Resistance Midpoint Ground) Configuration**

---

Load distribution leads are connected to the load distribution devices as shown in Figure 3-11.

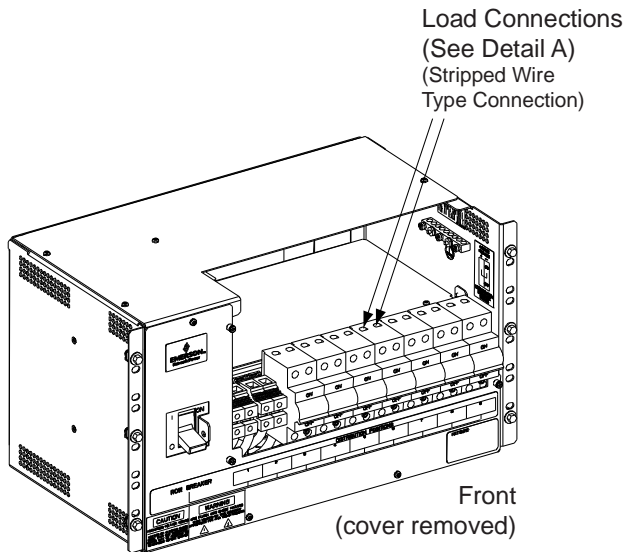
---

### **NPG (Negative Pole Ground) Configuration**

---

Load distribution leads are connected to the load distribution devices and return busbar as shown in Figure 3-11. Note that the return busbar is connected to ground as described in “NPG Configurations Only: Return Busbar (-Bus) Grounding Connection on page 17.

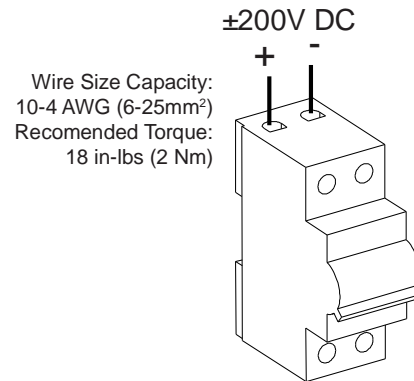
### Load Distribution Sub-Rack (HRMG Configurations)



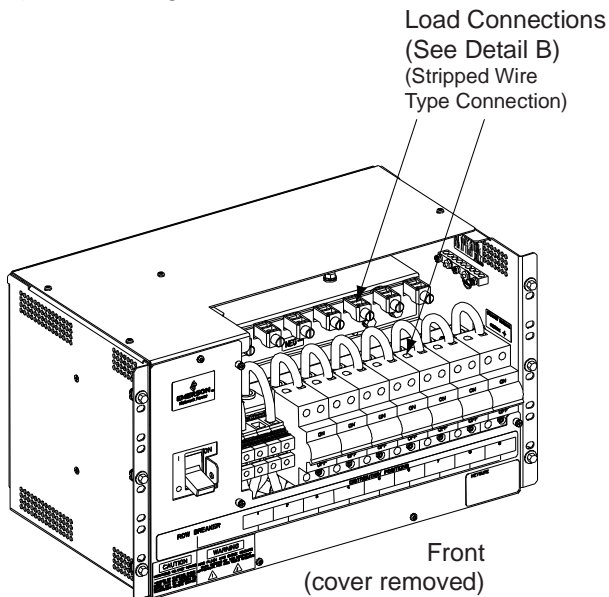
#### DETAIL A

Load Connections to  
Load Distribution Circuit Breakers

Field Connection to  
External Customer Loads.  
**OBSERVE CORRECT POLARITY.**



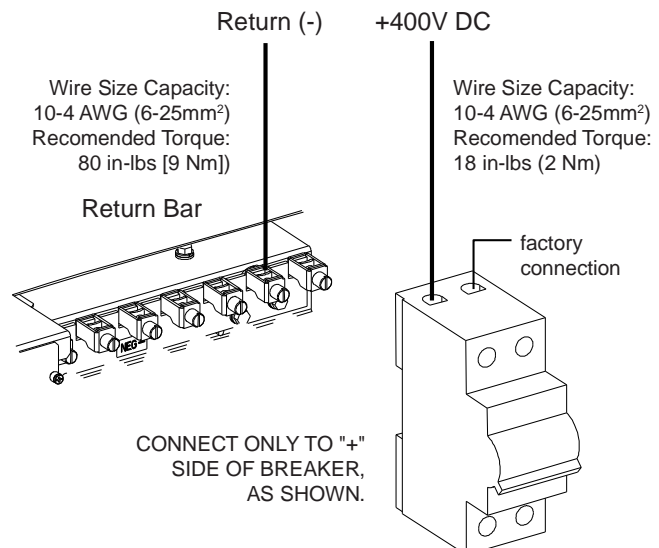
### Load Distribution Sub-Rack (NPG Configurations)



#### DETAIL B

Load Connections to  
Load Distribution Circuit Breakers and Return Bar

Field Connection to  
External Customer Loads.  
**OBSERVE CORRECT POLARITY.**



Caution: In the NPG Configuration, this equipment will have (after installation) a connection between the earthed conductor of the DC power supply circuit and the earthing conductor.

Figure 3-11  
DC Load Distribution Connections to Distribution Sub-Rack(s)



## Installing Battery Sub-Trays in List 91 and 92 Battery Tray(s) (if furnished)

**Danger:** Adhere to the “Important Safety Instructions” presented at the front of this document.

**Warning:** Ensure battery breaker on front of battery tray is turned off and locked-out before beginning work.

**Warning:** The battery tray is pre-wired with output battery cables with exposed ends. DO NOT install batteries into a battery tray that is not wired into the power and control sub-rack.

---

### Battery Manufacturer Information

---

Refer to System Application Guide SAG584000300 for specifications and manufacturers of the batteries to be installed in this power system.

---

### Installing Battery Sub-Trays

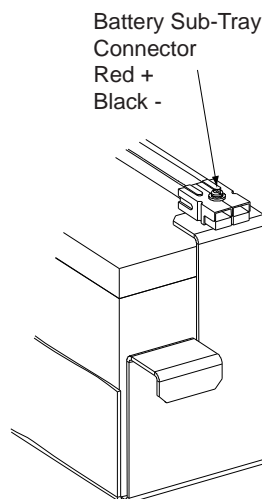
---

Batteries are furnished with this system but shipped separately. These batteries are packaged in six (6) battery sub-trays. All battery wiring within the battery sub-trays are done at the factory.

#### Procedure

Refer to Figure 3-12 as this procedure is performed.

- 1) ENSURE BATTERY BREAKER ON FRONT OF BATTERY TRAY IS TURNED OFF AND LOCKED-OUT.
- 2) Remove the battery retaining bracket from the rear of the battery tray.
- 3) Unpack the battery sub-trays.
- 4) In the battery sub-trays that hold five (5) batteries, one battery string cable is disconnected and sleeved at the factory for transportation. Locate this lead and connect it to the open battery terminal in that tray. See Figure 3-12.
- 5) Check each battery sub-tray voltage before installing as follows.
  - a) Battery sub-trays contain either four (4) or five (5) pre-wired battery blocks. Note that the minimum acceptable voltage of a single battery block is 11.5V DC. So, acceptable voltage of a battery sub-tray with four (4) battery blocks is  $11.5V \times 4 = 46V$  DC. Acceptable voltage of a battery sub-tray with five (5) battery blocks is  $11.5V \times 5 = 57.5V$  DC.
  - b) With an external meter, measure each battery sub-tray voltage at the battery sub-tray connector (see illustration in left margin). If battery sub-tray voltages are OK, install each battery sub-tray as detailed in the remaining steps of this procedure. Contact Emerson Technical Support if battery sub-tray voltages are not within limits. Contact information is provided on the inside back cover of this document.
- 6) If a battery temperature probe is to be used, it is recommended to secure it on top of a battery block near the location indicated in Figure 3-12.
- 7) Slide pre-wired battery sub-trays into battery tray.
- 8) Connect each battery sub-tray connector to the respective connector located on the battery tray.
- 9) Re-install the battery retaining bracket to the battery tray.



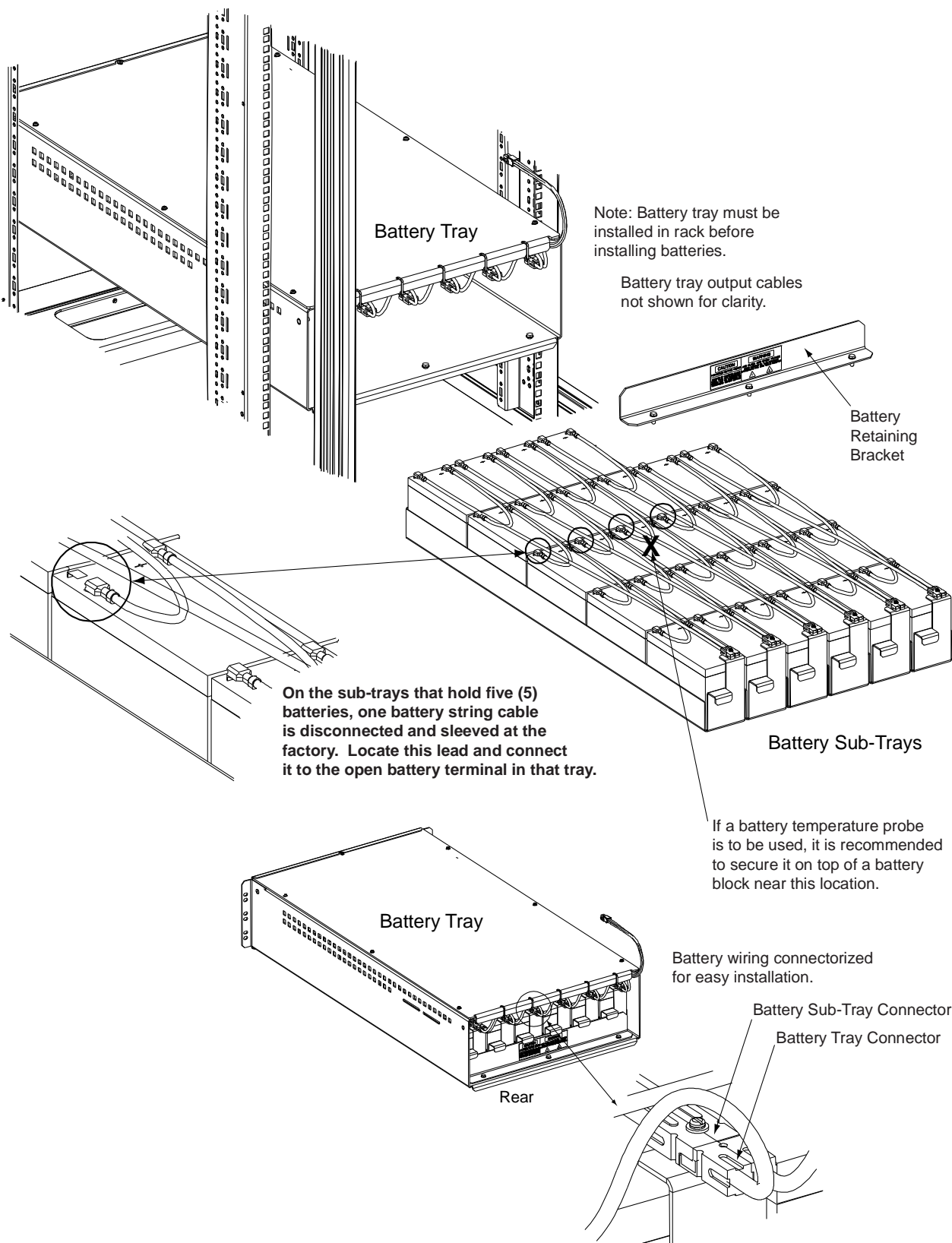


Figure 3-12  
Installing Battery Sub-Trays in List 91 and 92 Battery Tray(s)

## External Battery Connections (if required)

***Danger:*** Adhere to the “Important Safety Instructions” presented at the front of this document. ***DO NOT*** attempt to work on an energized system.

***Warning:*** Observe proper polarity when making battery connections.

Up to five internal or external battery strings can be connected to busbars located in the power and control sub-rack. If the system is furnished in a factory provided IT rack, connections to internal battery trays are factory made.

Connect any external battery strings to the positive and negative battery connection points per Figure 3-13. Cables can be routed from the top or bottom to the power and control sub-rack. Refer to SAG584000300 for wire size and crimp lug information.

If there is a battery breaker associated with the external battery string that is to be controlled (tripped) by the system’s LVD circuit, wire per Figure 3-13.

- Use 22 AWG (0.5mm<sup>2</sup>) wire.
- The mating connector for the alarm/control connector on the power and control sub-rack is P/N 247874900 (Tyco 172167-1).
- The mating contacts for the alarm/control connector on the power and control sub-rack is 245381700 (Tyco 170360-3) (22-18 AWG).
- The contacts are to be crimped with Tyco hand tool P/N 724651.

External battery breaker requirements are as follows.

- External battery breaker must contain a 48V shunt trip with the following specifications.
  - a) Rated Voltage: 12 to 60 VDC.
  - b) Maximum Release Duration: ≤ 10ms.
  - c) Minimum Resistance: >1 ohm.
- External battery breaker must contain auxiliary contacts that are normally closed if the breaker is close. Minimum contact rating is 48V DC at 2A.

Note: These connection points are used both for connecting external battery strings and the internal battery trays. A maximum of five (5) external and internal battery strings (total) can be connected to the power and control sub-rack.

\*Note: Battery cables can also be routed through the bottom of the power and control sub-rack.

### CUSTOMER CONNECTION TO EXTERNAL BATTERY STRINGS

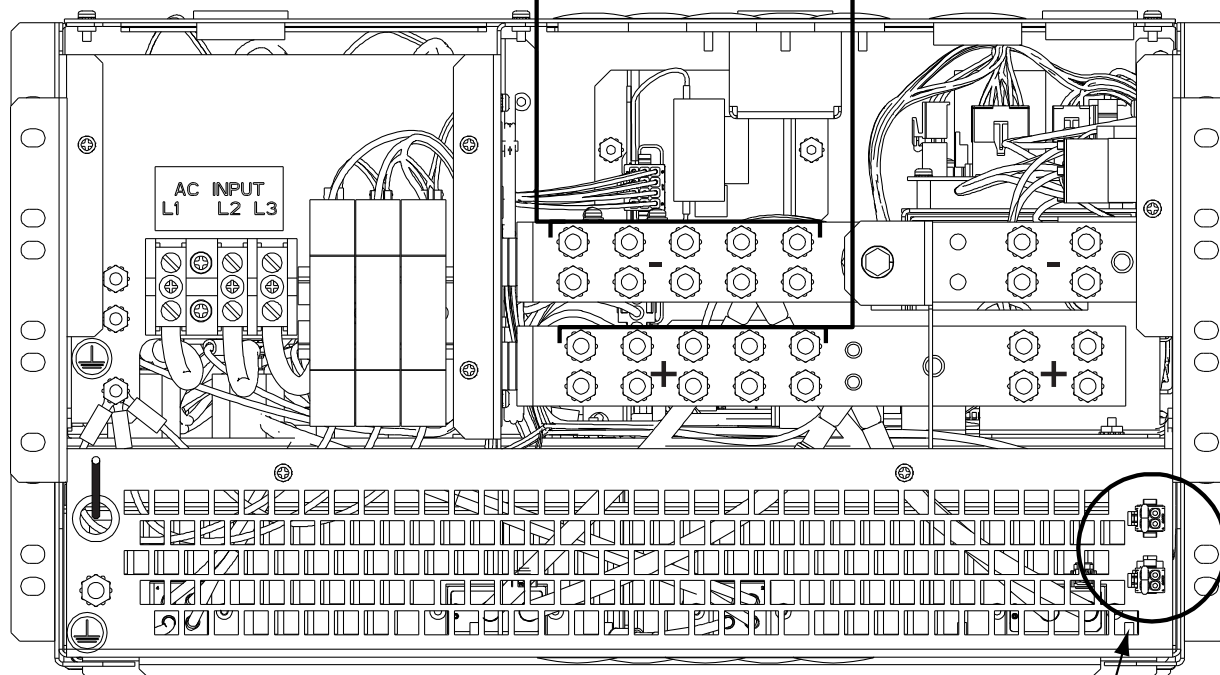
Battery Terminals for 400V DC Battery Strings  
(five sets of 1/4-20 x 1/2" studs on 5/8" centers  
for double hole lugs, each polarity)

Negative  
Battery\*

Positive  
Battery\*

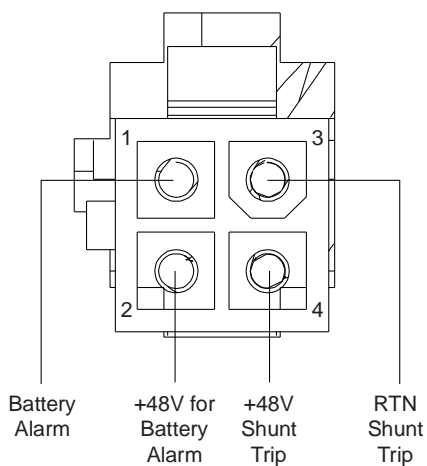
(Recommended  
Torque: 84 in-lbs  
[9 Nm])

Power and Control  
Sub-Rack



Rectifier Shelf Rear View  
(covers removed)

Control/Alarm  
Connector Pinouts



Internal/External Battery Tray  
Control/Alarm Connectors  
(Use either connector.)  
(If an internal or external  
battery tray is not connected,  
MUST have termination plugs  
installed.)

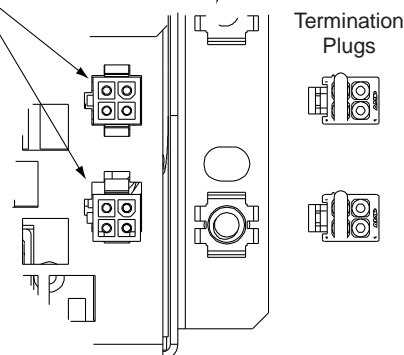


Figure 3-13  
External Battery Connections

## **IB2 (ACU+ Controller Interface Board) Connections (if required)**

The IB2 (ACU+ Controller Interface Board) provides connection points for digital inputs, programmable relay outputs, and temperature probes. The IB2 interface board is accessed from the front of the power and control sub-rack. Loosen the two captive fasteners and slide the tray the IB2 assembly is mounted to out far enough to make the electrical connections. Refer to Figure 3-14.

When connecting input and output wires to the IB2 board, route the leads through the opening provided on the top of the power and control sub-rack for I/O wiring (see Figure 3-14), through the I/O wiring cable tray, and out to the IB2 assembly at the front of the system.

**Note:** *The IB2 board is isolated from the system's 400VDC bus and the internal 48V bias supplies. If a voltage potential is required to be connected to digital inputs and/or relay contacts, customer must supply the voltage source.*

---

### **Digital Inputs and Programmable Relay Outputs**

---

Digital input and relay output leads are connected to screw-type terminal blocks located on the IB2. Recommended torque for these connections is 2.2 in-lbs (0.25 Nm). Refer to Table 3-1 and Table 3-2 for pin-out information.

#### **Digital Inputs**

Connect up to eight (8) digital inputs to the IB2 (ACU+ Controller Interface Board). Note that you must supply both paths for the digital input (either a positive or negative signal and the opposite polarity return path). Observe proper polarity. Refer to Figure 3-14 for terminal locations and Table 3-1 for pin-out information.

The digital inputs can be programmed to provide an alarm when the signal is applied (HIGH) or removed (LOW). Refer to the ACU+ Controller Operation Instructions (UM1M820NNB-1) for programming information.

Digital Input Ratings: Refer to the following.

- a) Maximum Voltage Rating: 60V DC.
- b) Active High: > 19V DC.
- c) Active Low: < 1V DC.

#### **Programmable Relay Outputs**

The IB2 provides eight programmable alarm relays with dry Form-C contacts. Refer to the ACU+ Controller Operation Instructions (UM1M820NNB-1) for programming information. Connect up to eight (8) relay outputs to the IB2. Refer to Figure 3-14 for terminal locations and Table 3-2 for pin-out information.

Relay Ratings: Refer to the following.

- a) 1A Steady State @ 30V DC.
- b) 3A Peak @ 30V DC.

---

## Temperature Probes

---

**Note:** *Each temperature probe consists of two pieces that plug together to make a complete probe. See SAG584000300 for part numbers and descriptions.*

Up to two (2) temperature probes can be connected to the IB2. Any combination of the two (2) temperature probes can be programmed to monitor ambient air temperature and/or battery temperature. A temperature probe set to monitor battery temperature can also be used for the rectifier battery charge temperature compensation feature. The battery charge temperature compensation feature allows the controller to automatically increase or decrease the output voltage of the system to maintain battery float current as battery temperature decreases or increases, respectively. Battery life can be extended when an optimum charge voltage to the battery with respect to temperature is maintained. A temperature probe set to monitor battery temperature can also be used for the BTRM (battery thermal runaway management) feature. The BTRM feature lowers output voltage when a high temperature condition exist to control against battery thermal runaway. Refer to the ACU+ Controller Operation Instructions (UM1M820NNB-1) for programming information.

A temperature probe programmed to monitor battery temperature should be mounted on the top or side of a battery block to sense battery temperature. A temperature probe used for battery charge temperature compensation and/or BTRM (Battery Thermal Runaway Management) should also be mounted on the top or side of a battery block. A temperature probe programmed to monitor ambient temperature should be mounted in a convenient location, away from direct sources of heat or cold.

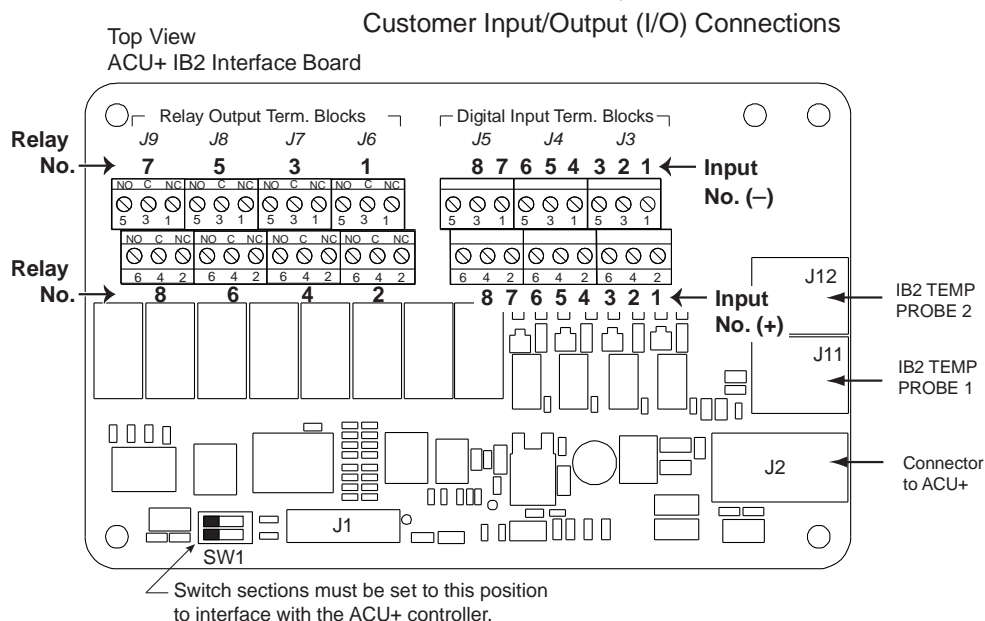
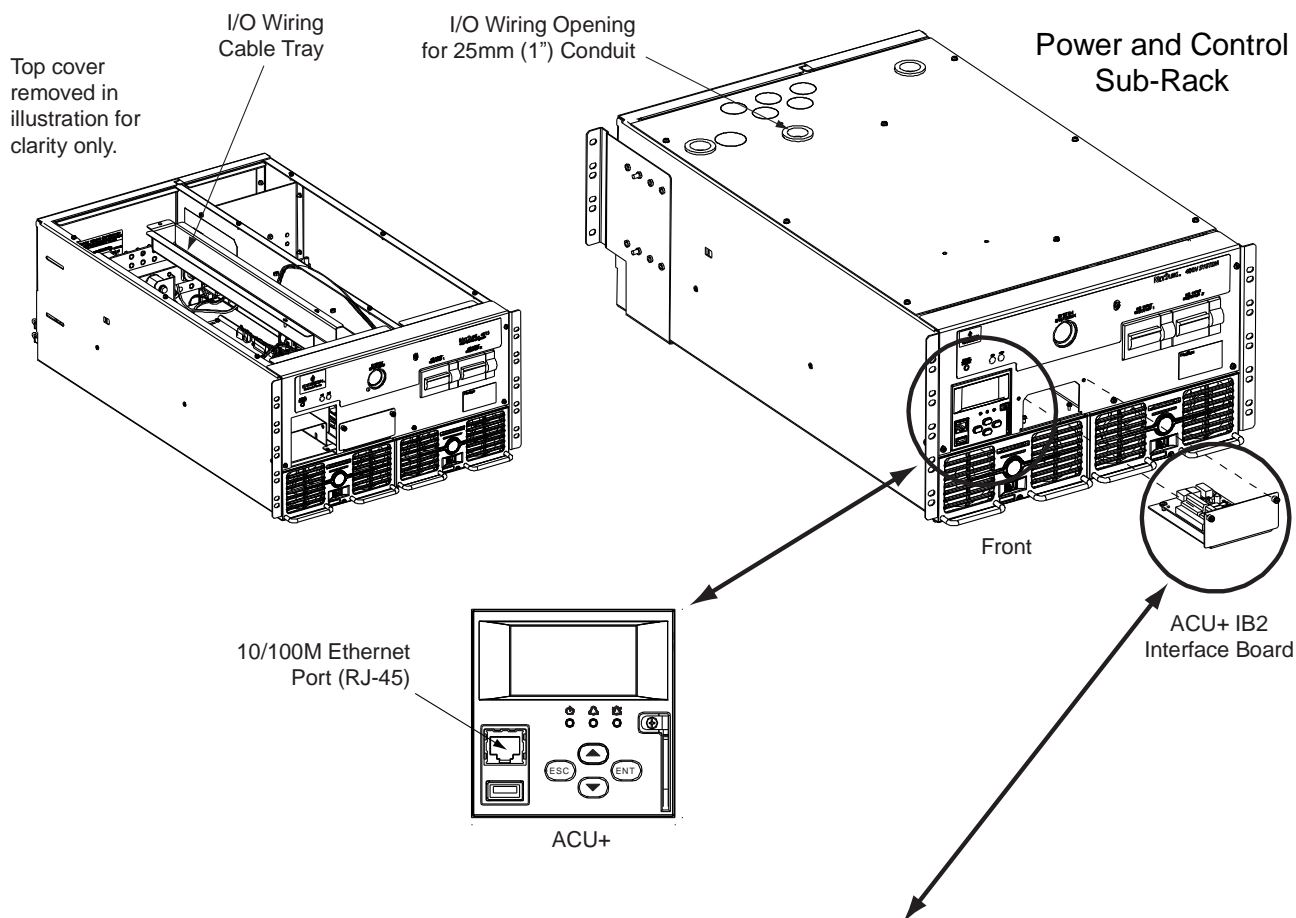
- **Recommended Battery Temperature Probe Location for Furnished List 91, 92 Battery Tray:** If a battery temperature probe is to be used, it is recommended to secure it on top of a battery block near the location indicated in Figure 3-12.

## ACU+ Controller Ethernet Connection (if required)

The ACU+ Controller provides a Web Interface via an Ethernet connection. This interface can be accessed locally on a computer or remotely through a network. An RJ-45 10BaseT jack is provided on the front of the ACU+ Controller for connection to a computer or into a customer's network. This jack has a standard Ethernet pin configuration scheme, twisted pair. Refer to Figure 3-14 for location. Use shielded Ethernet cable (grounded at both ends). Note that the ACU+ RJ-45 jack is connected to chassis ground. Refer to the ACU+ Controller Operation Instructions (UM1M820NNB-1) for operational details.

**Warning:** *The intra-building port(s) of the equipment or subassembly is suitable for connection to intra-building or unexposed wiring or cabling only. The intra-building port(s) of the equipment or subassembly MUST NOT be metalically connected to the interfaces that connect to the OSP or its wiring. These interfaces are designed for use as intra-building interfaces only (Type 2 or Type 4 ports as described in GR-1089-CORE, Issue 4) and require isolation from the exposed OSP cabling. The addition of Primary Protectors is not sufficient protection in order to connect these interfaces metalically to OSP wiring.*

*The intra-building port (RJ-45) of the equipment or subassembly must use shielded intra-building cabling/wiring that is grounded at both ends.*



**J3-J9:**  
Wire Size Capacity: 16-26 AWG (1.5-0.5mm<sup>2</sup>).  
Recommended Torque: 2.2 in-lbs (0.25 Nm).

Figure 3-14  
External Interface Connections

Programmable Digital Input	Pin No.		Default Digital Input Function	Customer Defined Digital Input Function
1	J3-2	+	none	
	J3-1	—		
2	J3-4	+	none	
	J3-3	—		
3	J3-6	+	none	
	J3-5	—		
4	J4-2	+	none	
	J4-1	—		
5	J4-4	+	none	
	J4-3	—		
6	J4-6	+	none	
	J4-5	—		
7	J5-2	+	none	
	J5-1	—		
8	J5-4	+	none	
	J5-3	—		
--	J5-5		not used	not used
--	J5-6			

Table 3-1  
Programmable Digital Inputs



Programmable Relay Output		IB2 Pin No.	Alarms Assigned to this Relay (Default)	Alarms Assigned to this Relay (Custom)
1	NO	J6-5	none	
	COM	J6-3		
	NC	J6-1		
2	NO	J6-6	none	
	COM	J6-4		
	NC	J6-2		
3	NO	J7-5	none	
	COM	J7-3		
	NC	J7-1		
4	NO	J7-6	none	
	COM	J7-4		
	NC	J7-2		
5	NO	J8-5	none	
	COM	J8-3		
	NC	J8-1		
6	NO	J8-6	none	
	COM	J8-4		
	NC	J8-2		
7	NO	J9-5	none	
	COM	J9-3		
	NC	J9-1		
8	NO	J9-6	none	
	COM	J9-4		
	NC	J9-2		

Table 3-2  
Programmable Relay Outputs

## Power and Control Sub-Rack Bulk Output Connections (if required)

**Danger:** Adhere to the “Important Safety Instructions” presented at the front of this document. **DO NOT** attempt to work on an energized system.

**Warning:** Check for correct polarity before making connections.

**Note:** These connection points may not be available if DC load distribution sub-racks are installed. The power and control sub-rack provides connection points for up to two (2) total DC load distribution sub-racks / bulk output combinations.

Refer to Figure 3-15 for connection details. Refer to SAG584000300 for wire size and crimp lug information.

### CUSTOMER CONNECTION TO BULK DISTRIBUTION

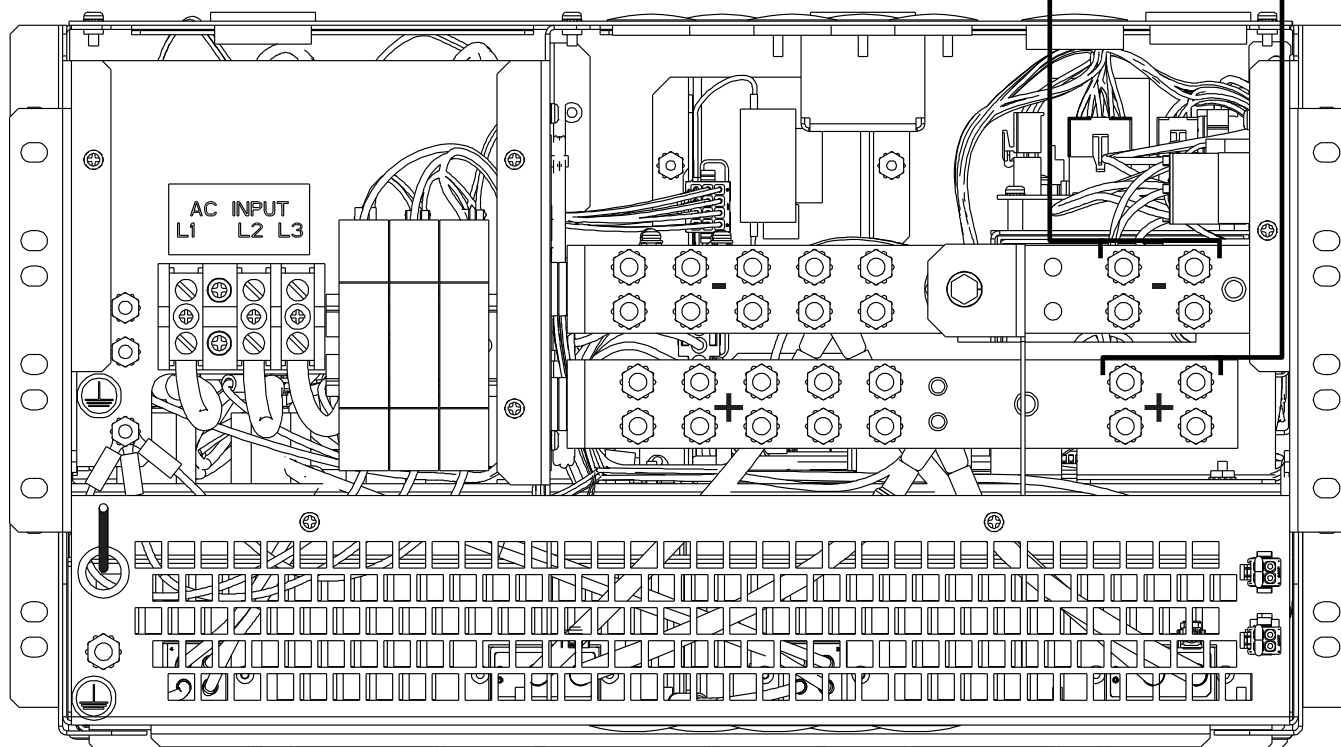
Caution: In the NPG Configuration, this equipment will have (after installation) a connection between the earthed conductor of the DC power supply circuit and the earthing conductor.

400V DC Output Terminals  
(two sets of 1/4-20 x 1/2" studs  
on 5/8" centers for double  
hole lugs, each polarity)

Negative Output      Positive Output

(Recommended  
Torque: 84 in-lbs  
[9 Nm])

### Power and Control Sub-Rack



Rear View  
(covers removed)

Figure 3-15  
Bulk DC Distribution Connections to Power and Control Sub-Rack

## CHAPTER 4. INSTALLING THE RECTIFIER MODULE

The rectifier module is hot swappable. It can be installed with the system operating if these instructions are carefully followed.

**Note:** *There is a two step insertion process.*

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### Procedure

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- 1) Unpack the rectifier module.
- 2) Open the respective rectifier module's AC input circuit breaker on the front of the power and control sub-rack.
- 3) Place the "Latch Release" located on the front of the rectifier module to the LEFT position. See Figure 4-1.
- 4) Place the rectifier module into an unoccupied mounting slot without sliding it in completely. Gently push the rectifier module into the mounting slot until it stops. Note that the rectifier module will NOT be completely seated in the mounting slot until the next step is performed.
- 5) Live Systems: Wait for the green power indicator to illuminate. Ensuring the green power indicator stays on, slide the "Latch Release" located on the front of the rectifier module to the RIGHT position. Gently push the rectifier module into the mounting slot until it is completely seated.
- De-energized Systems: Slide the "Latch Release" located on the front of the rectifier module to the RIGHT position. Gently push the rectifier module into the mounting slot until it is completely seated.
- 6) Secure the rectifier module to the power and control sub-rack by tightening the retaining screw.
- 7) Repeat the above steps for each rectifier module being installed in the system.
- 8) After the rectifier modules are physically installed in their mounting slots, they are ready for operation immediately after power is supplied to them.
- 9) Close the respective rectifier module's AC input circuit breaker on the front of the power and control sub-rack.

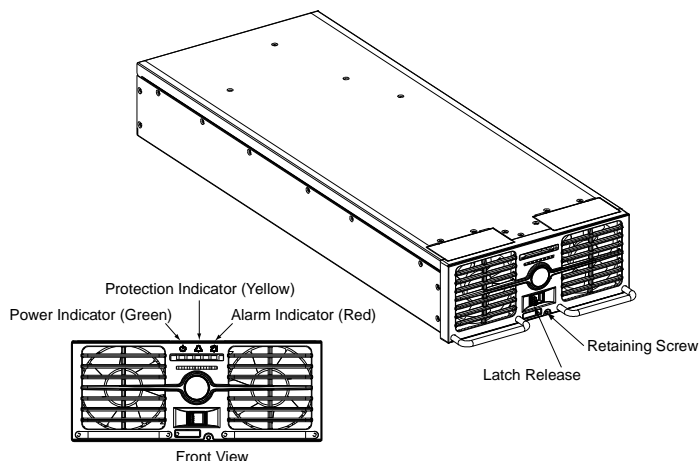


Figure 4-1  
Installing a Rectifier Module

## CHAPTER 5. INITIALLY STARTING THE SYSTEM

**Caution:** *Performing various steps in the following procedures may cause a service interruption and/or result in the extension of alarms. Notify any appropriate personnel before starting these procedures. Also, notify personnel when these procedures are completed.*

**Note:** *Contact Emerson sales for startup assistance.*

### INITIAL STARTUP PREPARATION

Refer to Figure 5-1 for circuit breaker locations.

- Ensure that all blocks in the appropriate “Installation Acceptance Checklist” starting on page 6 have been checked (except the last one).
- Ensure that a rectifier module or a blank cover panel is installed in all rectifier mounting positions.
- Ensure the distribution row input circuit breaker is in the OFF position (if furnished).
- Ensure each load distribution circuit breaker is in the OFF position.
- Ensure each rectifier module AC input circuit breaker is in the OFF position.
- Ensure each battery tray circuit breaker is in the OFF position.

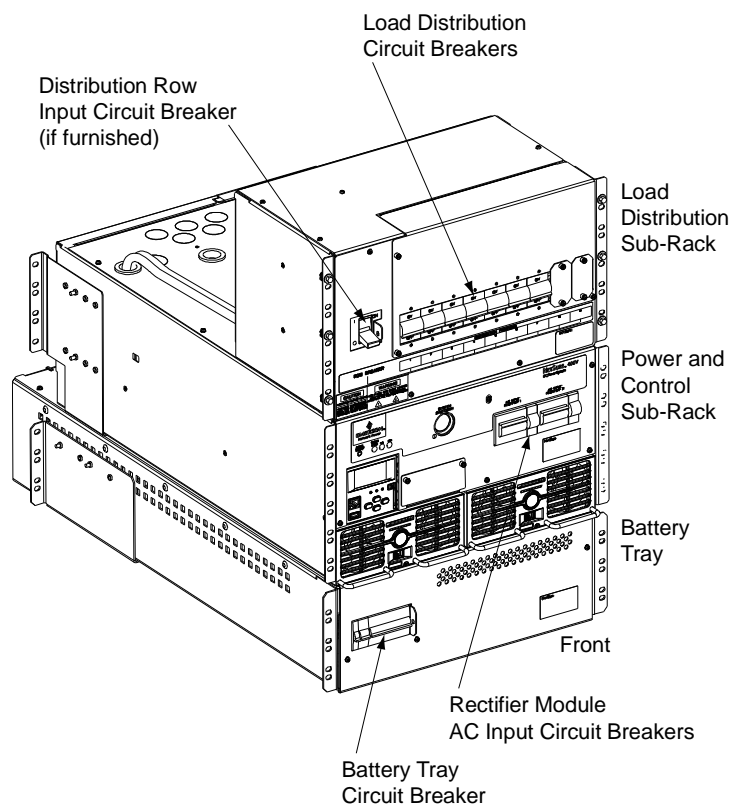


Figure 5-1  
Circuit Breaker Locations

## INITIALLY STARTING THE SYSTEM

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### Procedure

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- 1) Close the external AC disconnect or protective device that supplies AC power to the system.
- 2) Place each rectifier module AC input circuit breaker located on the front of the power and control sub-rack to the ON position. Rectifiers automatically start.
- 3) Place each internal battery tray circuit breaker to the ON position. Place each external battery string circuit breaker to the ON position.
- 4) Place each distribution row input circuit breaker located on the load distribution sub-rack to the ON position (if furnished).
- 5) Place each load distribution circuit breaker located on the load distribution sub-rack to the ON position.

## ACU+ CONTROLLER INITIALIZATION

**Note:** For factory configured systems, your controller was programmed with a configuration file that sets all adjustable parameters. Provided on a USB drive furnished with the system is an ACU+ configuration drawing (C-drawing) and the ACU+ configuration files loaded into the ACU+ as shipped. If ordered for customer integration, you will have to program the controller for your application per step 8) below.

Refer to the ACU+ Controller Operation Instructions (UM1M820NNB-1) for detailed instructions.

Refer to Figure 5-2 for locations of the ACU+ local indicators and navigation keys.

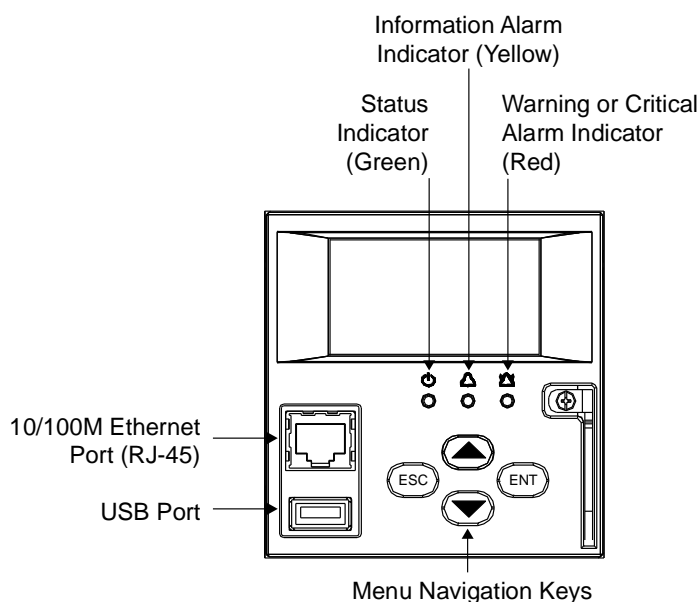


Figure 5-2  
ACU+ Controller Local Indicators and Navigation Keys

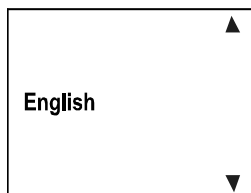
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### Procedure

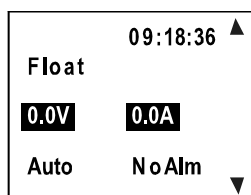
**Note:** The initialization routine takes several minutes. During that time various alarm indicators may illuminate on the ACU+ front panel and an audible alarm may sound. Disregard all alarms. An audible alarm can be silenced at any time by momentarily depressing the **ENT** key on the ACU+ Controller.

- 1) After the ACU+ is powered on, the display alternates between the “**Emerson Network Power**” screen and a screen displaying “**Advanced Control Unit Plus Version \*\*\*\*\* Starting...**”.

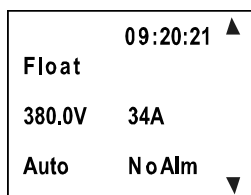
- 2) Next, the language screen appears. Press the up or down arrow key to select the desired language. Press the **ENT** key to confirm the selection. If no key is pressed within 10 seconds, the ACU+ selects the displayed language automatically.



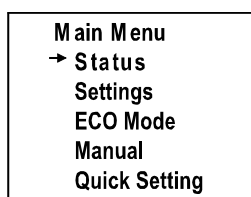
- 3) As initialization continues, the Main screen is displayed, but with zero volts. Initialization is not complete.



- 4) When initialization is complete, the Main screen displays voltage and current normally, and no alarms are active.



- 5) System information is displayed in multiple screens. Repetitively press the up or down arrow key to view other system information screens one by one.
- 6) From the Main screen, press **ENT** to go to the "Main Menu" screen.



- 7) From the Main Menu, select a sub-menu by repetitively pressing the up or down arrow key. The selected sub-menu will be indicated by the cursor. Press **ENT** to open the sub-menu.

**Note:** Repeatedly press the "ESC" key to return in reverse order level by level from any sub-menu until the Main screen appears.

- 8) Verify and set the ACU+ Controller as required for your application. Refer to the ACU+ Controller Operation Instructions (UM1M820NNB-1) for procedures. Note that you will have to program the ACU+ for any temperature probes and external inputs/outputs connected to the IB2 Interface Board, and battery capacity if different than the factory default of 8.5 Ah (8.5 Ah per internal battery tray).

## VERIFYING THE CONFIGURATION FILE

For factory configured systems, your ACU+ was programmed with a configuration file that sets all adjustable parameters. The version number of the configuration file can be found on the configuration drawing (C-drawing) that is supplied with your power system documentation, and on a label located on the ACU+. You can verify that the correct configuration file has been loaded into your ACU+ by performing the following procedure.

---

### Procedure

---

**Note:** When viewing any of the following screens, if a key is not depressed within approximately 10 seconds, the ACU+ will automatically return to the Main screen.

- 1) With the Main screen displayed, press **ESC**. A screen displays the serial number and software version.
- 2) Press **ENT**. A screen displays the hardware version and MAC address.
- 3) Press **ENT**. A screen displays the configuration version number.
- 4) Press **ESC**, or wait approximately 10 seconds, to return to the Main screen.

## CHANGING BATTERY CAPACITY RATING IN THE ACU+

To change the battery capacity setting of the ACU+ to match the battery connected to the power system, perform the following procedure.

---

### Procedure

---

- 1) With the Main screen displayed, press **ENT** to go to the Main Menu. Navigate to and select **"Settings"** (ENT).
- 2) If a password screen opens, a password must be entered to allow the User to make adjustments. If a password was previously entered and has not yet timed out, skip this step and proceed to step 3). Otherwise, to enter a password, with the cursor at the User Name field (default is "Admin"), press the down arrow key to move cursor down to the password line. Press **ENT**. "0" is highlighted. Press the up arrow key once to change the "0" to "1" (default password is "1"), then press **ENT** twice. (**Note:** If you have been assigned a unique User Name and password, follow this procedure to enter these.)
- 3) With the Settings menu screen displayed, navigate to and select **"Battery"** (ENT) / **"Basic"** (ENT).
- 4) Navigate to **"Rated Capacity"**. Press **ENT**. Use the up or down keys to adjust the value as required. Press **ENT**.

**Note:** For NetSure 4000 Series Battery Tray's, the capacity value is 8.5 A-hr per tray. For customer provided batteries, enter the C10 battery capacity rating in A-hr.

- 5) Return to the Main screen by repeatedly pressing **ESC** (escape).



## CHECKING BASIC SYSTEM SETTINGS

Navigate through the controller menus and sub-menus to check system settings. You can adjust any parameter as required. Note that these settings can also be checked (and changed if required) via the WEB Interface.

**Note:** *Repeatedly press the “ESC” key to return in reverse order level by level from any sub-menu until the Main screen appears.*

---

### Procedure

---

#### To Select a Sub-Menu:

Press the up or down arrow keys to move the cursor up and down the list of sub-menus in the menu screen (selects the sub-menu), then press **ENT** to enter the selected sub-menu.

#### To Enter a Password:

If a password screen opens, a password must be entered to allow the User to make adjustments. To enter a password, with the cursor at the User Name field (default is “Admin”), press the down arrow key to move cursor down to the password line. Press **ENT**. “0” is highlighted. Press the up arrow key once to change the “0” to “1” (default password is “1”), then press **ENT** twice. (**Note:** *If you have been assigned a unique User Name and password, follow this procedure to enter these.*)

#### To Change a Parameter:

Press the up or down arrow keys to move the cursor up and down the list of parameters in the menu screen (selects the parameter to change), then press **ENT** to change the selected parameter. The parameter field highlights. Press the up or down arrow keys to change the parameter value. Press **ENT** to confirm the change.

Table 5-1 shows the menu navigation for some basic settings. (Refer to the ACU+ Controller Operation Instructions (UM1M820NNB-1) for details and additional settings.)

Parameter	Menu Navigation
<b>Date</b>	Main Menu / Settings / Controller / Date
<b>Time</b>	Main Menu / Settings / Controller / Time
<b>IP Communications Parameters</b> (IP address, subnet mask address, gateway address)	Main Menu / Settings / Communication
<b>Float Voltage</b>	Main Menu / Settings / Battery / Charge / Operating Voltage
<b>Equalize Voltage</b>	Main Menu / Settings / Battery / Charge / Batt EQ Voltage
<b>Battery Capacity</b>	Main Menu / Settings / Battery / Basic / Rated Capacity
<b>BTRM Feature</b>	Main Menu / Settings / Battery / Basic / BTRM Action Main Menu / Settings / Battery / Basic / BTRM Voltage
<b>Temperature Compensation Center Temperature</b>	Main Menu / Settings / Battery / Temp Comp / TempComp Center
<b>Temperature Compensation Slope</b>	Main Menu / Settings / Battery / Temp Comp / TempComp Coeff
<b>Maximum Temperature Compensation Voltage</b>	Main Menu / Settings / Battery / Temp Comp / Max TempComVolt
<b>High Voltage Shutdown Limit</b>	Main Menu / Settings / Rectifier / All Rect Set / HVSD Limit
<b>Over Voltage Alarm</b>	Main Menu / Settings / Power System / General / Over Voltage
<b>Under Voltage Alarm</b>	Main Menu / Settings / Power System / General / Under Voltage

Table 5-1  
Basic Settings Local Menu Navigation

## CONFIGURING THE ACU+ IDENTIFICATION OF RECTIFIERS

When rectifier modules are all installed prior to applying power and starting the system, the order in which the ACU+ identifies the rectifiers is by serial number (lowest serial number is Rect 1, next lowest is Rect 2, etc.). If you prefer the ACU+ to identify the rectifiers by position in the system, perform the following procedure.

---

### Procedure

---

- 1) With the Main screen displayed, press **ENT** to go to the Main Menu. Navigate to and select **"Settings"** (ENT).
  - 2) If a password screen opens, a password must be entered to allow the User to make adjustments. If a password was previously entered and has not yet timed out, skip this step and proceed to step 3). Otherwise, to enter a password, with the cursor at the User Name field (default is "Admin"), press the down arrow key to move cursor down to the password line. Press **ENT**. "0" is highlighted. Press the up arrow key once to change the "0" to "1" (default password is "1"), then press **ENT** twice. (*Note: If you have been assigned a unique User Name and password, follow this procedure to enter these.*)
  - 3) With the Settings menu screen displayed, navigate to and select **"Rectifier"** (ENT).
  - 4) Navigate to **"Rect #"** (# is used here to represent the rectifier identification number). Press **ENT**. The rectifier # menu screen is displayed, and the green LED on one rectifier starts flashing. This is the rectifier currently identified by the ACU+ as rectifier #. (If this is not the rectifier you want, press **ESC** to return to rectifier menu screen and select a different rectifier.)
  - 5) Navigate to and select **"Rectifier ID"**. Press **ENT**. Use the up or down keys to change the ACU+ identification number for the flashing rectifier. Press **ENT**.
  - 6) Press **ESC** to return to rectifier menu screen.
  - 7) Repeat steps 4) through 6) for each of the remaining rectifiers in the system.
  - 8) When you have finished selecting identification numbers for all rectifiers, repeatedly press **ESC** to return to the Main Menu.
  - 9) Navigate to and select **"Manual"** (ENT) / **"Rectifier"** (ENT) / **"All Rect Ctrl"** (ENT).
  - 10) Navigate to **"Confirm ID/PH"**. Press **ENT**. **"Yes"** highlights.
  - 11) Press **ENT** to select the operation. Press **ENT** again to confirm.
- Note:** Check your numbering to be sure it is correct. If there where conflicts in your numbering, rectifiers with conflicts will be assigned the next available sequential number.*
- 12) Return to the Main screen by repeatedly pressing **ESC** (escape).

## CHECKING THE SYSTEM SHUTDOWN CIRCUIT

### Procedure

- 1) With the system operating, momentarily depress the System Shutdown pushbutton located on the power and control sub-rack.
- 2) Verify that the rectifier module AC input circuit breakers located on the power and control sub-rack and the battery circuit breaker located on the internal battery trays open.
- 3) Restart the system by first turning ON the rectifier module AC input circuit breakers then the battery circuit breaker(s).

## CHECKING SYSTEM STATUS

### Procedure

- 1) Observe the status of the indicators located on the ACU+ Controller, rectifier modules, and power and control sub-rack. If the system is operating normally, the status of these is as shown in Table 5-2.







Component	Indicator		Normal State
<b>ACU+ Controller</b>	Status (Green)		On
	Information (Yellow)		Off
	Warning or Critical Alarm (Red)		Off
<b>Rectifier Modules</b>	Power (Green)		On
	Protection (Yellow)		Off
	Alarm (Red)		Off
<b>Power and Control Sub-Rack</b>	Output Voltage Present (Green)		On
	PS1 Indicator (Green)		On
	PS2 Indicator (Green)		On
	Ground Fault Alarm (HRMG Configurations Only) (Red)		Off

Table 5-2  
Status and Alarm Indicators

## FINAL STEPS

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### Procedure

---

- 1) If any ACU+ Controller configuration settings were changed, refer to the ACU+ User Instructions (UM1M820NNB-1) and save a copy of the configuration file. This file can be used to restore the ACU+ Controller settings, if required, at a later date.
  - Note that provided on a USB drive furnished with the system is an ACU+ configuration drawing (C-drawing) and the ACU+ configuration files loaded into the ACU+ as shipped.
- 2) Verify there are no external alarms and the local indicators are as shown in Table 5-2.

## REFERENCE DOCUMENTS

Refer to “Customer Documentation Package” on page 1 for a list of other documents that can be referenced for additional information.

## REVISION RECORD

Issue	Change Number (ECO)	Description of Change
AA	LLP216775	New
AB	LLP218630	Misc. updates. System packaging tables revised.

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